

STUDIES IN THE FLORA OF BOLIVIA — IV.

GRAMINEAE

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To anyone who has made use of Hitchcock's treatment of the central and northern Andean grasses (Contrib. U. S. Nat. Herb. 24, pt. 8 [1927]), my indebtedness will be obvious. I have followed it in the arrangement of genera and species, with such interpolations as time and the accretion of further material have made necessary. Since Hitchcock's work was published almost forty years ago, it is not surprising that genera and species not known to him from Bolivia have now been found there. In the matter of species-concepts and synonymy, too, Hitchcock has been followed, almost without exception. This is conservative, perhaps ultraconservative, but that seems preferable to over-recognition of categories of possibly uncertain value. It also means that if Hitchcock made errors they are perpetuated here.

A non-agrostologist is perhaps too greatly impressed by the number of exceptions and qualifications made necessary in writing keys if the genera are first divided into tribes. Consequently, a continuous key is provided for the 109 genera treated in this paper. It is based, like the generic descriptions, on the species found in Bolivia, not on extra-territorial species. Certain points as to its terminology should be noted. A fertile floret may be either perfect or pistillate; when necessary, specific use is made of one term or the other. A sterile floret may be staminate, neuter, or a rudiment. Most often, the term is applied to an empty lemma. Again, a primary division is made on the basis of the disarticulation of spikelets — above the glumes and not above the glumes. This phraseology has been deliberately used rather than above the glumes and below the glumes. It is made necessary by the fact that in some genera both glumes are lacking. Disarticulation may also occur in the pedicels or in the rachis itself, which is somewhat too far

below the glumes to permit even a broad use of that expression.

Once again, this paper is based on the collections of the Gray Herbarium (GH). These have been supplemented by material borrowed from the incomparable collection of *Gramineae* in the United States National Herbarium (US). I am much indebted to Dr. W. L. Stern and Dr. T. R. Soderstrom for their generous coöperation. In some cases, where Bolivian material has not been seen, collections seen by previous workers have been cited, with that worker's name in parentheses.

For corrections and additions to this paper, I shall be most grateful.

KEY TO GENERA

1. Inflorescences not surrounded by a hard bony involucre.
 2. Disarticulation above the glumes.
 3. Spikelets 1-flowered.
 4. Inflorescence a solitary, terminal, pedunculate spikelet. 44. *Aciachne*.
 4. Inflorescence not a solitary, terminal, pedunculate spikelet.
 5. Rachilla prolonged as a bristle behind the palea.
 6. Inflorescence not digitate. 37. *Calamagrostis*.
 6. Inflorescence digitate. 57. *Cynodon*.
 5. Rachilla not prolonged behind the palea, except in the central spikelets only in *Hordeum*.
 7. Inflorescence a terminal spike.
 8. Spikelets 3 at a node, not unilateral on the rachis. 26. *Hordeum*.
 8. Spikelets solitary at nodes, unilateral on the rachis. 58. *Microchloa*.
 7. Inflorescence a panicle.
 9. Spikelets paired, 1 pistillate and sessile, 1 staminate and pedicellate. 67. *Pharus*.
 9. Spikelets not paired.
 10. Awn of lemma excentric (in side view).
 11. Lemma enclosing the membranous palea. 46. *Nassella*.
 11. Lemma not entirely enclosing the coriaceous bicarinate palea. 47. *Piptochaetium*.
 10. Awn of lemma not excentric, or lemma awnless or cuspidate.

- 12. Awn of lemma trifid. 49. *Aristida*.
- 12. Awn of lemma, if present, undivided.
- 13. Lemma shorter than glumes.
 - 14. Lemma neither fusiform nor indurate. 38. *Agrostis*.
 - 14. Lemma fusiform, indurate. 48. *Stipa*.
- 13. Lemma equal to glumes or longer than at least 1 glume.
 - 15. Lemma awnless. 45. *Sporobolus*.
 - 15. Lemma awned or cuspidate.
 - 16. Awn dorsal 43. *Trinichloa*.
 - 16. Awn terminal, if present, otherwise the lemma cuspidate. 42. *Muhlenbergia*.
- 3. Spikelets more than 1-flowered.
 - 17. Spikelets with fertile florets only.
 - 18. Rachilla villous.
 - 19. Lemma with the true awn 1.1-2.2 cm. long. 16. *Cortaderia*.
 - 19. Lemma with the true awn about 4 mm. long. 30. *Koeleria*.
 - 18. Rachilla glabrous.
 - 20. Florets distant, glumes minute. 7. *Aphanelytrum*.
 - 20. Florets not distant, glumes not minute.
 - 21. Spikelets and glumes over 1 cm. long. 14. *Arundo*.
 - 21. Spikelets and glumes less than 1 cm. long.
 - 22. Glumes less than 2 mm. long. 8. *Puccinellia*.
 - 22. Glumes more than 2 mm. long.
 - 23. Glumes shorter than lemmas. 19. *Anthochloa*.
 - 23. Glumes longer than lemmas. 22. *Triodia*.
 - 17. Spikelets with fertile and sterile florets, or the florets all pistillate or all staminate.
 - 24. Plants dioecious.
 - 25. Rachilla villous. 16. *Cortaderia*.
 - 25. Rachilla glabrous.
 - 26. Leaf-blades about 1 mm. wide; inflorescence a rather condensed panicle. 13. *Distichlis*.
 - 26. Leaf-blades to 4-6 cm. wide; inflorescence a plumose panicle. 17. *Gynerium*.

- 24. Plants not dioecious.
- 27. Fertile florets above the sterile florets in the spikelet.
 - 28. Lateral nerves of first glume with a row of tubercles bearing long golden-brown hairs. 70. *Tristachya*.
 - 28. Lateral nerves of first glume not tuberculate, not with long golden-brown hairs.
 - 29. Spikelets strongly flattened and imbricate. 64. *Phalaris*.
 - 29. Spikelets not strongly flattened and imbricate.
 - 30. Spikelets with more than 1 fertile floret.
 - 31. Inflorescence a plumose panicle. 15. *Phragmites*.
 - 31. Inflorescence not a plumose panicle.
 - 32. Leaf-blades linear, to 6 mm. wide. 1. *Arthrostylidium*.
 - 32. Leaf-blades lanceolate, to 3 cm. wide. 2. *Arundinaria*.
 - 30. Spikelets with only 1 fertile floret.
 - 33. Fertile branches fascicled at nodes of main plant-axis; terminal floret perfect. 3. *Chusquea*.
 - 33. Fertile branches not fascicled at nodes of main plant-axis; terminal floret pistillate.
 - 34. Lemma of pistillate floret glabrous or scabridulous. 68. *Arundinella*.
 - 34. Lemma of pistillate floret densely long-pubescent. 69. *Trichopteryx*.
- 27. Fertile florets below the sterile florets in the spikelet.
 - 35. Inflorescence condensed into small glomerules more or less hidden by leaf-sheaths. 63. *Munroa*.
 - 35. Inflorescence not condensed into glomerules.
 - 36. Inflorescence digitate or paniculate (in one instance a panicle with whorls of digitately arranged branches).
 - 37. Inflorescence digitate.
 - 38. Rachis prolonged beyond the uppermost spikelet as a short subulate point. 56. *Dactyloctenium*.

- 38. Rachis not prolonged beyond the uppermost spikelet.
- 39. Spikelets with more than 1 perfect floret. 55. *Eleusine*.
- 39. Spikelets with only 1 perfect floret. 60. *Chloris*.
- 37. Inflorescence a panicle.
- 40. Lemma wing-margined. 11. *Briza*.
- 40. Lemma not wing-margined.
- 41. Rachilla glabrous.
- 42. Glumes or lemmas awned.
- 43. Spikelets unilateral in 2 rows on the rachis. 61. *Trichloris*.
- 43. Spikelets not unilateral on the rachis.
- 44. Lemmas longer than glumes.
- 45. Inflorescence a spicate, dense, interrupted panicle. 31. *Trisetum*.
- 45. Inflorescence an open racemose panicle. 53. *Gouinia*.
- 44. Lemmas shorter than glumes. 59. *Gymnopogon*.
- 42. Glumes and lemmas awnless.
- 46. Spikelets unilateral on the the rachis in 2 rows. 52. *Leptochloa*.
- 46. Spikelets not unilateral on rachis in 2 rows.
- 47. Glumes longer than lemmas.
- 48. Spikelets paired, 1 sessile and 1 pedicellate. .. 34. *Holcus*.
- 48. Spikelets not paired.
- 49. Inflorescence spicate, dense. .. 29. *Dissanthellium*.

- 49. Inflorescence not
spicate, the
branches dis-
tant, spreading.
..... 18. *Melica*.
- 47. Glumes equal to or
shorter than lemmas.
- 50. Leaf-blades long-
petiolate, lance-
ovate.
..... 21. *Zeugites*.
- 50. Leaf-blades not
long-petiolate nor
lance-ovate.
- 51. Paleas persist-
ent on rachilla
after fall of
lemmas.
.. 12. *Eragrostis*.
- 51. Paleas not per-
sistent. .. 10. *Poa*.
- 41. Rachilla not glabrous.
- 52. Lemma not bidentate.
- 53. Lemma apically dissected
into numerous awns.
..... 23. *Pappophorum*.
- 53. Lemma not apically dis-
sected.
- 54. Paleas persistent on
rachilla after fall of
lemmas.
..... 12. *Eragrostis*.
- 54. Paleas not persistent.
- 55. Spikelets 1.5 cm.
long or longer.
..... 4. *Bromus*.
- 55. Spikelets rarely
longer than 1 cm.,
usually shorter.
- 56. Glumes longer
than lemmas. ..
..... 18. *Melica*.
- 56. Glumes equal to
or shorter than
lemmas.

- 57. Lemmas
awnless.
..... 10. *Poa*.
- 57. Lemmas
awned.
.. 6. *Festuca*.
- 52. Lemma bidentate or 4-
toothed.
- 58. Lemma-awn dorsal.
- 59. Spikelets 1.5-2.5 cm.
long. 33. *Avena*.
- 59. Spikelets 4-5 mm. long.
..... 32. *Deschampsia*.
- 58. Lemma-awn from base of
sinus between teeth.
- 60. Spikelets about 2.5 cm.
long. 4. *Bromus*.
- 60. Spikelets 1.5 cm. or
less.
- 61. Glumes shorter
than lemmas.
..... 31. *Trisetum*.
- 61. Glumes longer than
lemmas.
- 62. Spikelets 1.5 cm.
long.
- 63. Leaves glab-
rous.
9. *Amphibro-
mus*.
- 63. Leaves papil-
late - hirsute.
.... 35. *Dan-
thonia*.
- 62. Spikelets about
7 mm. long.
.... 36. *Lampro-
thyrsus*.
- 36. Inflorescence neither digitate nor pani-
culate, but a solitary terminal spike or
raceme.
- 64. Inflorescence a raceme with few,
distant, ultimately spreading spikelets.
..... 5. *Brachypodium*.
- 64. Inflorescence a terminal spike.

- 65 Spikelets placed edgewise to the rachis. 27. *Lolium*.
- 65. Spikelets not placed edgewise to the rachis.
 - 66. Glumes awned. 25. *Elymus*.
 - 66. Glumes awnless.
 - 67. Glumes shorter than lemmas. 54. *Tripogon*.
 - 67. Glumes not shorter than lemmas.
 - 68. Plants 1-2 dm. high; spikes 1-3 cm. long. 62. *Bouteloua simplex*.
 - 68. Plants to 1-2 m. high; spikes 7-20 cm. long. 24. *Agropyron*.
- 2. Disarticulation not above the glumes.
 - 69. Spikelets 1-flowered.
 - 70. Spikelets with unisexual or neuter florets.
 - 71. Inflorescence a spicate panicle or raceme.
 - 72. Inflorescence a raceme.
 - 73. Spikelets in whorls around the rachis. 28. *Pariana*.
 - 73. Spikelets not in whorls around the rachis. 51. *Aegopogon*.
 - 72. Inflorescence a spicate panicle. 41. *Lycurus*.
 - 71. Inflorescence a panicle but not spicate in appearance.
 - 73a. Pistillate and staminate spikelets in separate inflorescences on the same plant. 66. *Luziola*.
 - 73a. Pistillate and staminate spikelets not in separate inflorescences.
 - 74. Spikelets not paired. 94. *Olyra*.
 - 74. Spikelets paired. 100. *Hyparrhenia*.
 - 70. Spikelets with perfect florets.
 - 75. Inflorescence a raceme or spike.
 - 76. Inflorescence a raceme. 51. *Aegopogon*.
 - 76. Inflorescence a spike. 50. *Tragus*.
 - 75. Inflorescence a panicle.
 - 77. Glumes lacking. 65. *Leersia*.
 - 77. Glumes present.
 - 78. Spikelets paired.
 - 79. One spikelet perfect, the other staminate or neuter. 41. *Lycurus*.
 - 79. One spikelet perfect and sessile, the other pistillate and pedicellate. 97. *Eriochrysis*.
 - 78. Spikelets not paired.
 - 80. Spikelets awnless. 20. *Orthoclada*.

- 80. Spikelets awned.
 - 81. Inflorescence not interrupted. 39. *Alopecurus*.
 - 81. Inflorescence interrupted. 40. *Polypogon*.
- 69. Spikelets with 2 or more florets.
 - 82. Fertile floret below the sterile floret.
 - 83. Inflorescence a panicle; spikelets usually solitary. 20. *Orthoclada*.
 - 83. Inflorescence of pectinately arranged spikes; spikelets not solitary. 62. *Bouteloua*.
 - 82. Fertile floret above the sterile floret.
 - 84. Spikelets subtended by bristles, these separate, or at least partially united and forming a bur.
 - 85. Spikelets and bristles forming a bur. 93. *Cenchrus*.
 - 85. Spikelets and bristles not forming a bur.
 - 86. Bristles persistent. 91. *Setaria*.
 - 86. Bristles deciduous. 92. *Pennisetum*.
 - 84. Spikelets not subtended by bristles.
 - 87. First glume absent.
 - 88. Spikelets without unisexual florets.
 - 89. Spikelets not unilateral on the rachis. 71. *Leptocoryphium*.
 - 89. Spikelets unilateral on the rachis.
 - 90. Second glume and fertile lemma turned away from the rachis. 80. *Axonopus*.
 - 90. Second glume and fertile lemma turned toward the rachis (first glume rarely present but minute).
 - 91. Fruit flexible, cartilaginous, usually dark. 73. *Digitaria*.
 - 91. Fruit rigid, chartaceous, usually light. 81. *Paspalum*.
 - 88. Spikelets with unisexual florets; pistillate and staminate florets in separate spikelets. 94. *Olyra*.
 - 87. First glume present.
 - 92. Second glume ventricose and uncinately spiny at maturity. 75. *Pseudechinolaena*.
 - 92. Second glume not ventricose nor uncinately spiny at maturity.
 - 93. Spikelets paired, with 1 spikelet sessile, the other pedicellate.
 - 94. Both spikelets, or only 1, with a perfect floret.
 - 95. Both spikelets with a perfect floret.

- 96. Spikelets awnless.
..... 96. *Saccharum*.
- 96. Spikelets awned. .. 98. *Erianthus*.
- 95. One spikelet with a perfect floret.
- 97. Perfect spikelet pedicellate.
..... 104. *Trachypogon*.
- 97. Perfect spikelet sessile.
- 98. Disarticulation immediately
below glumes.
..... 99. *Andropogon*.
- 98. Disarticulation not immedi-
ately below glumes, but in
rachis or pedicel.
- 99. First glume concealing the
rest of the spikelet.
..... 107. *Hackelochloa*.
- 99. First glume not conceal-
ing spikelet.
- 100. Inflorescence a soli-
tary raceme (occa-
sionally more than 1).
- 101. Spikelets awned. ..
.... 103. *Hetero-
pogon*.
- 101. Spikelets awnless.
- 102. Glumes pubes-
cent, hirsute or
villous.
..... 105. *Elyo-
nurus*.
- 102. Glumes glab-
rous.
..... 106. *Mani-
suris*.
- 100. Inflorescence panicu-
late.
- 103. Pedicellate spike-
let staminate.
.... 101. *Sorghum*.
- 103. Pedicellate spike-
let reduced to a
pedicel.
..... 102. *Sorghas-
trum*.
- 94. Neither spikelet with a perfect floret.
..... 108. *Tripsacum*.
- 93. Spikelets not paired, or if in pairs, not

with 1 spikelet sessile and the other pedicellate.

104. Inflorescence of solitary, or mostly so, racemes.

105. Spikelets paired. 74. *Thrasya*.

105. Spikelets unpaired, but sometimes in 2 rows.

106. Spikelets (pistillate only) sunken in rachis. 108. *Tripsacum*.

106. Spikelets not sunken in rachis.

107. Sterile lemma and second glume with tufts of hairs. .. 77. *Mesosetum*.

107. Sterile lemma and second glume glabrous. 79. *Brachiaria*.

104. Inflorescence a panicle.

108. Spikelets paired.

109. Glumes awnless.

110. Sterile lemma and second glume alike. 72. *Trichachne*.

110. Sterile and fertile lemmas alike, unlike second glume. 95. *Imperata*.

109. Glumes awned or mucronate.

111. Ring-callus on rachilla at base of spikelet. 78. *Eriochloa*.

111. Ring-callus absent from rachilla. 89. *Oplismenus*.

108. Spikelets unpaired or clustered.

112. Spikelets clustered.

113. Spikelets awnless, not plano-convex. 86. *Hymenachne*.

113. Spikelets awned, plano-convex. 90. *Echinochloa*.

112. Spikelets unpaired.

114. Spikelets placed obliquely on pedicels. 84. *Lasiacis*.

114. Spikelets not placed obliquely on pedicels.

115. Spikelets awnless.

116. Second glume inflated, saccate. 85. *Sacciolepis*.

- 116. Second glume not inflated nor saccate.
- 117. Lemma stipitate. ..
.... 83. *Ichnanthus*.
- 117. Lemma not stipitate.
- 118. Spikelets with 2 perfect florets, subglobose.
.... 88. *Isachne*.
- 118. Spikelets with 1 perfect floret, not subglobose.
- 119. First glume as long as spikelet.
.. 87. *Homolepis*.
- 119. First glume not as long as spikelet.
.... 82. *Panicum*.
- 115. Spikelet awned or mucronate.
- 120. Ring-callus on rachilla at base of spikelet.
..... 78. *Eriochloa*.
- 120. Ring-callus absent.
- 121. Glumes very unequal.
..... 76. *Rhynchelytrum*.
- 121. Glumes equal or subequal.
.... 89. *Oplismenus*.
- 1. Inflorescences, at least the pistillate, surrounded by a hard bony involucre. 109. *Coix*.

1. *Arthrostylidium* Rupr.

Arthrostylidium racemiflorum Steud. Syn. Pl. Glum. 1: 336 (1854). Perennial, climbing or sprawling, to 5 m. long; main axis to 5 mm. thick, the fertile branches clustered at the nodes. Leaf-blades linear, to 6 mm. wide, often short-pubescent above and beneath, with scattered longer hairs. Inflorescence racemose, the racemes to 8 cm. long, the

rachis pubescent. Spikelets few-flowered, the lowest lemmas empty; disarticulation above the glumes. Lemma to 6 mm. long, 7-nerved, awned, the awn 1-2 mm. long. Palea longer than the lemma, the keels ciliolate. SANTA CRUZ: ICHILO: Río Yapacani, 350 m., *Steinbach* 7587 (GH).

This collection is a sterile sheet identified by Mrs. Agnes Chase as "probably" this species.

2. *Arundinaria* Michx.

Arundinaria Herzogiana Henrard in Meded. Rijks Herb. Leiden, no. 40: 75 (1921). Shrubby perennial. Leaf-sheaths long-fimbriate at the apex, the fimbriae to 2 cm. long; blades lanceolate, acute, to 25 cm. long and 3 cm. wide, glaucous, glabrous above, scabrous and more or less hirtellous beneath. Inflorescence a terminal, lax, racemose panicle to 3 dm. long, hardly, if at all, exserted from the uppermost leaves, the pubescent branches distant on the axis. Spikelets 2-3 cm. long, pedicellate, about 5-flowered; disarticulation above the glumes. First glume absent; second glume about 1 mm. long, 3-nerved, the margin ciliate, with a 3-4 mm. awn. Sterile lemmas 2, awned, the first pubescent on the upper portion. Fertile lemmas to 1 cm. long, 7-nerved, shortly puberulent, with a 2-3 mm. awn. LA PAZ: INQUISIVI [?]: Río Saujana, 3200 m., *Herzog* 2396 (US; type-number).

There is no information available as to the height of the plant.

3. *Chusquea* Kunth

Shrubby perennials, sometimes low-growing, or the culms 2-7 m. long, slender to stout, woody. Leaf-blades lanceolate to linear-lanceolate, 2-18 cm. long, acute, disarticulating from the persistent sheaths. Fertile branches loosely to densely fascicled at the nodes, or the inflorescences terminal on the culms; inflorescence an open to rather crowded panicle, or spicate in appearance, spikelets few to numerous in an inflorescence. Spikelets pedicellate, small; glumes present or absent; sterile lemmas 2, below 1 perfect floret; disarticulation above the glumes.

- a. Glumes absent or less than 0.5 mm. long.
 - b. Glumes absent. 2. *C. delicatula*.
 - b. Glumes present, less than 0.5 mm. long.
 - c. Culms 2-7 m. long, 1 cm. thick; fertile stems densely clustered at nodes, with numerous spikelets. 4. *C. peruviana*.
 - c. Culms much shorter, 4 mm. thick; fertile stems few at nodes, spikelets few. 1. *C. uniflora*.
- a. Glumes present, 1 mm. long, or more.
 - d. Rachis, branches and pedicels glabrous. 5. *C. serrulata*.
 - d. Rachis, branches and pedicels puberulent.

- e. Spikelets mostly distinctly pedicellate, the panicle somewhat open; lemmas distinctly awned. 6. *C. scandens*.
- e. Spikelets rarely pedicellate, the inflorescence densely spicate in appearance, lemmas shortly mucronate. 3. *C. spicata*.
- 1. ***Chusquea uniflora*** Steud. Syn. Pl. Glum. 1: 327 (1854). *C. longipendula* O. Ktze. Rev. Gen. 3(2): 348 (1898). Leaf-blades pubescent or glabrous beneath. Spikelets to 7 mm. long, sterile and fertile lemmas strongly carinate, the keel prolonged as a distinct scabrous awn. LA PAZ: NOR YUNGAS: Bella Vista, *Hitchcock* 22753 (GH).
- 2. *C. delicatula* Hitchcock in Contrib. U. S. Nat. Herb. 23: 309 (1927). Leaf-blades glabrous beneath. Spikelets 5-6 mm. long; sterile lemmas ending in a short subulate point. LA PAZ: NOR YUNGAS: Bella Vista, *Hitchcock* 22748 (GH; type-number).
- 3. *C. spicata* Munro in Trans. Linn. Soc. 26: 60 (1868). Leaf-blades glabrous beneath, the margins densely ciliolate. Spikelets about 6 mm. long. LA PAZ: LARECAJA: Mapiri, *Rusby* 196 (Hitchcock).
- 4. *C. peruviana* E. G. Camus, Bamb. Monogr. 88, t. 53B (1913). Leaf-blades sparsely pilose beneath, the apex long-setaceous. Spikelets glabrous, to 10 mm. long, the lemmas shortly mucronate. LA PAZ: NOR YUNGAS: Bella Vista, *Hitchcock* 22746 (GH), 22744 (GH).
- 5. *C. serrulata* Pilger in Engler, Bot. Jahrb. 25: 719 (1898). Leaf-blades glabrous beneath. Spikelets about 7 mm. long, the lemmas mucronate. LA PAZ: MURILLO: La Paz, *Rusby* 10 (Hitchcock); NOR YUNGAS: Bella Vista, *Hitchcock* 22750 (GH); Coroico, *Bang* 2348 (GH); SUR YUNGAS: Colaya, 1810 m., *Mexia* 4298 (GH).
- 6. *C. scandens* Kunth, Syn. Pl. Aequin. 1: 254 (1822). *C. quitensis* var. *patentissima* Hack. in Fedde, Rep. Sp. Nov. 6: 161 (1908). Leaf-blades somewhat pilose beneath, the apex setaceous. Spikelets about 8 mm. long. LA PAZ: NOR YUNGAS: Unduavi, 3300 m., *Buchtien* 4185 (GH); Bella Vista, *Hitchcock* 22747 (GH).

4. **Bromus** L.

Annual or perennial, the culms erect or spreading, sometimes prostrate. Inflorescence a terminal racemose panicle, the spikelets several- to many-flowered, the puberulent rachilla disarticulating above the unequal glumes, the lemmas awned or awnless, glabrous or pubescent, the uppermost floret a sterile lemma or a rudiment.

- a. Glumes scabridulous to scabrous, but not puberulent nor pubescent.
 - b. Lemmas pubescent, awn twisted. 1. *B. Trinii*.
 - b. Lemmas not pubescent or only very slightly so, awn not twisted.
 - c. Leaf-blades to 1 cm. wide; lemma tuberculate-scabridulous. 2. *B. segetum*.
 - c. Leaf-blades to 5 mm. wide; lemma not tuberculate-scabridulous. 3. *B. catharticus*.
- a. Glumes puberulent to pubescent.

- d. Inflorescence-rachis and pedicels short-pubescent. 4. *B. lanatus*.
 d. Inflorescence-rachis and pedicels scabridulous but not pubescent.
 5. *B. pitensis*.

1. ***Bromus Trinii*** Desv. in Gay, Fl. Chile, 6: 441 (1853). Annual, to 6 dm. high, the culms, inflorescence-rachis and pedicels glabrous. Leaves sparsely pilose on the sheaths, the blades pilose, at least when young. Spikelets to a little over 2 cm. long, about 7-flowered, the uppermost floret reduced to a narrow sterile lemma. First glume about 1.1 cm. long, 1-nerved; second glume about 1.3 cm., 3-nerved, the nerves green. Lowest lemma about 1 cm. long, 2-toothed, the teeth very evident, the awn about 1.4 cm. long. Palea about 9 mm. long, bicarinate, the keels ciliate near the apex. LA PAZ: LARECAJA: Sorata, Mandon 1370 (US).

2. ***B. segetum*** HBK. Nov. Gen. & Sp. 1: 151 (1816). Perennial, the panicle to 2 dm. long, culms, rachis and pedicels glabrous. Leaves glabrous, the blades scabridulous beneath. Spikelets to 1.5 cm. long, 2-4-flowered, the uppermost floret reduced to a rudiment. First glume 5 mm. long, 1-nerved, the second glume to 8 mm. long, 3-nerved. Lowest lemma about 1.2 cm. long, shortly bidentate, awn about 2 mm. long. Palea as long as lemma, bidentate, bicarinate, the keels ciliate. COCHABAMBA: CHAPARE: La Aduana, 3000 m., Steinbach 9533 (GH).

3. ***B. catharticus*** Vahl, Symbol. Bot. 2: 22 (1791). *B. unioides* HBK. Nov. Gen. & Sp. 1: 151 (1816). *B. angustatus* Pilger in Engler, Bot. Jahrb. 25: 719 (1898). Annual or perennial, the culms glabrous, the rachis and pedicels scabridulous, the open panicles to 3 dm. long. Leaf-sheaths glabrous, blades scabridulous beneath. Spikelets about 2.5 cm. long, with up to 9 florets, the uppermost a rudiment. First glume to 9 mm. long, 3-nerved, the second glume to 1 cm., 5-nerved. Lowest lemmas to 1.4 cm. long, not toothed, awn about 5 mm. long, upper lemmas awnless. Palea to 1.3 cm. long, bidentate, bicarinate, the keels long-ciliate. LA PAZ: MURILLO: La Paz, 3700 m., Buchtien 8533 (GH). COCHABAMBA: CERCADO: Valle de Cochabamba, Steinbach 8798 (GH). TARIJA: CERCADO: Calderillo, 3200 m., Fiebrig 2904 (GH).

Very variable in size, spikelet-length and awn-length. Many lemmas awnless.

4. ***B. lanatus*** HBK. Nov. Gen. & Sp. 1: 150 (1816). *B. Pflanzii* Pilger in Engler, Bot. Jahrb. 49: 189 (1912). Perennial, to 6 dm. high, the leaf-blades somewhat villous. Panicle very lax, 10-20 cm. long. Spikelets to 2 cm. long, with about 6 florets, the uppermost a rudiment. First glume to 1 cm. long, 3-nerved, the second glume to 1.3 cm. long, 5-nerved. Lowest lemmas about 1.2 cm. long, densely villous along the margins, shortly bidentate, the awn 4-5 mm. long. Palea about 1 cm. long, bicarinate, the keels ciliate. LA PAZ: INGAVI: Comanche, Asplund 6459 (Hitchcock). TARIJA: CERCADO: Calderillo, 3200 m., Fiebrig 2904 in part (GH).

5. ***B. pitensis*** HBK. Nov. Gen. & Sp. 1: 152 (1816). *B. Buchtienii*

Hack. in Fedde, Rep. Sp. Nov. 11: 30 (1912). Perennial, to 1.5 m. high. Leaf-blades glabrous or somewhat pilose. Panicles lax, up to 3 dm. long. Spikelets to 2.5 cm. long, up to 9-flowered. First glume about 6 mm. long, 1-nerved, the second glume about 9 mm. long, 3-nerved. Lowest lemmas to 1.3 cm. long, bidentate, sparsely pubescent or villous on the lower half, the awn 4 mm. long. Palea about 1.1 cm. long, bidentate, bicarinate, the keels ciliate. Anthers villous at base. LA PAZ: LARECAJA: Sorata, 2600-2800 m., *Mandon* 1365 (GH); MURILLO: La Paz, 3800 m., *Buchtien* 518 (GH).

5. *Brachypodium* Beauv.

Brachypodium mexicanum Link, Hort. Berol. 1: 41 (1827). Perennial, straggling, to 6 dm. high. Leaves glabrous, the blades usually much shorter than the inflorescence, scabridulous beneath, acute, to 1.2 cm. wide, usually narrower. Inflorescence a solitary, terminal raceme of a few distant spikelets, these at first appressed, ultimately spreading or deflexed, the raceme to 10 cm. long. Spikelets to 2.5 cm. long (excluding the awns), subterete, to 10-flowered, the glabrous or upper portion and downward along the lateral nerves, awned, the minutely puberulent rachilla disarticulating above the glumes; glumes unequal, the first about 6 mm. long, the second to 7 mm. long, both awnless; lemmas about 9 mm. long, 5-7-nerved, puberulent on the awn about 4-6 mm. long, the 2 uppermost florets reduced and sterile; palea as long as the lemma, bicarinate, the keels densely ciliate. LA PAZ: LARECAJA: Sorata, *Holway* 544 (US). COCHABAMBA: CERCADO: Cochabamba, Tequiña, *Hitchcock* 22855 (US), *Holway* 409 (US).

6. *Festuca* L.

Annual or perennial, of varying heights. Leaves flat or involute, shorter than or exceeding the inflorescence. Inflorescence a terminal racemose panicle, the spikelets few- to several-flowered, the puberulent rachilla disarticulating above the unequal or subequal glumes. Lemmas firm to somewhat indurate in texture, awned, awn-tipped or awnless, the uppermost reduced and sterile.

- a. First glume 1 mm. long or less; lemmas ciliate at apex, tuberculate-scabridulous. 1. *F. megalura*.
- a. First glume at least 1.5 mm. long; lemmas not ciliate at apex, not tuberculate-scabridulous.
 - b. Lemmas with awns at least 5 mm. long. 2. *F. ulochaeta*.
 - b. Lemmas awn-tipped (about 1 mm.) or awnless.
 - c. Rachis and pedicels scabrid to pubescent; lemmas not pubescent along margin.
 - d. Lemmas (at least some) awn-tipped.
 - e. Leaf-blades flat. 3. *F. procera*.
 - e. Leaf-blades involute and pungent.
 - f. Lemmas glabrous or puberulous at apex. .. 4. *F. sublimis*.

- f. Lemmas scabridulous at apex. 5. *F. rigescens*.
 d. Lemmas awnless 7. *F. dolichophylla*.
 c. Rachis and pedicels glabrous; lemmas pubescent along margin.
 6. *F. orthophylla*.

1. ***Festuca megalura*** Nutt. in Journ. Acad. Sci. Philad. (ser. 2) 1: 188 (1848). Annual. Panicles narrow, usually over 10 cm. long, often exceeded by the uppermost flat glabrous leaf-blades. Spikelets (excluding awns) about 1 cm. long, with 4-5 florets. Glumes unequal, the first about 1 mm. long or less, the second, 2.5-3 mm. long. Lowest lemmas to 5 mm. long with a 1.5 cm. scabrid awn, upper lemmas long-ciliate near the apex, most lemmas tuberculate-scabridulous (at least in dried material). Palea as long as lemma, bicarinate, the ciliate keels nearly marginal. LA PAZ: LARECAJA: vic. Sorata; Ullontiji, 2650-2900 m., *Mandon* 1363 (GH). COCHABAMBA: CHAPARE: Incachaca 2250 m., *Steinbach* 9498 (GH); CERCADO: south side of Mt. Tunari, 3300 m., *Steinbach* 9850 (GH). POTOSÍ: CERCADO: Potosí, *Cárdenas* 203 (GH). TARIJA: CERCADO: Calderillo, 3200 m., *Fiebrig* 3159 (GH).

2. ***F. ulochaeta*** Steud. Syn. Pl. Glum. 1: 305 (1854). Perennial, up to 1 m. high, the culms, rachis and pedicels scabrid, leaf-blades sometimes exceeding the inflorescence, to 5-8 mm. wide, scabrid beneath. Panicle fairly lax, to 2 dm. long. Spikelets (excluding awns) about 8 mm. long, 4-5 flowered. Glumes 1.5 and 2.5 mm. long. Lowest lemmas 5-6 mm. long, convex to rounded, 3-nerved, the central nerve scabridulous at apex, awns very filiform, flexible, 5-8 mm. long. Palea as long as lemma, bicarinate, the keels ciliolate. LA PAZ: MURILLO: Unduavi, *Buchtien* 6415 (Hitchcock). COCHABAMBA: CHAPARE: Incachaca, 2300 m., *Steinbach* 8976 (GH).

3. ***F. procera*** HBK. Nov. Gen. & Sp. 1: 154 (1816). *F. Fiebrigii* Pilger in Engler, Bot. Jahrb. 37: 510 (1906). Perennial, to 1-2 m. high, the panicle to 3 dm. long; rachis and pedicels short-pubescent, leaf-blades narrow, flat or somewhat folded, scabrid beneath. Spikelets about 8 mm. long, 3-5-flowered. Glumes 4 mm. and 5 mm. long, the first 1-nerved, the keel scabrid near the apex, the second 3-nerved, at least the keel scabrid above. Lowest lemmas to 6-7 mm. long, rounded, several-nerved, scabrid to scabrid-puberulent, especially on the upper portion, awn-tipped. Palea as long as lemma, bicarinate, the keels ciliolate, bidentate, the apex puberulous. TARIJA: AVILES: Pinos, 2800 m., *Fiebrig* 3117 (GH; type number of *F. Fiebrigii*), 3118 (GH).

4. ***F. sublimis*** Pilger in Engler, Bot. Jahrb. 25: 718 (1898). Perennial, caespitose, to 1 m. high, the involute, glabrous to scabrid, pungent leaf-blades sometimes exceeding the inflorescence. Panicle fairly lax, to 2.5 dm. long, rachis and pedicels scabrid to short-pubescent. Spikelets about 1 cm. long, 4-flowered (in most). Glumes 4 mm. and 5 mm. long, the second minutely ciliolate and sometimes

scabridulous. Lowest lemmas about 7 mm. long, awnless, the upper ones awn-pointed (1 mm.), glabrous to puberulous. Palea as long as lemma, bidentate, puberulent, bicarinate, the keels ciliate. LA PAZ: LARECAJA: vic. Sorata; Chilcani, *Mandon* 1362 bis (GH).

5. *F. rigescens* (Presl) Kunth, Rév. Gram. 1: suppl. XXXI (1830). Caespitose perennial, to 4 dm. high, leaf-blades involute, pungent, glabrous, sometimes exceeding the narrow 5-20 cm. panicle, the rachis and pedicels puberulent. Spikelets to 1.1 cm. long, about 4-flowered. Glumes 6 mm. and 7 mm. long, the second scabridulous near the apex. Lowest lemmas to 8 mm. long, rounded, the apex scabridulous, sometimes slightly 2-toothed, awnless to awn-pointed. Palea shorter than lemma, puberulous on both surfaces, bicarinate, the keels ciliate. LA PAZ: YUNGAS, *Bang* 173 (GH); MURILLO: Palca, 3700 m., *Hitchcock* 22560 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 208 (GH).

6. *F. orthophylla* Pilger in Engler, Bot. Jahrb. 25: 717 (1898). *F. orthophylla* var. *boliviana* Pilger in Engler, Bot. Jahrb. 37: 508 (1906). Caespitose perennial, to 5 dm. high, leaves involute, glabrous, firm, pungent, often equaling or exceeding the inflorescence. Panicle narrow, the branches ascending, rachis and pedicels glabrous. Spikelets about 1 cm. long, 4-6-flowered. Glumes about equal, 6 mm. long, the first 1-nerved, the nerve scabrid, margins slightly ciliate, with an apical tuft of hairs, the second 3-nerved, broader than the first but otherwise similar. Lowest lemmas about 7 mm. long, awnless, pubescent along the margin. Palea as long as lemma, pubescent at apex, bicarinate, the keels ciliate, at least on the upper half. TARIJA: AVILES: Puna Patanca, 3700 m., *Fiebrig* 3192 (GH; type-number of *F. orthophylla* var. *boliviana*).

7. *F. dolichophylla* Presl, Rel. Haenk. 1: 258 (1830). *F. laeteviridis* Pilger in Engler, Bot. Jahrb. 37: 510 (1906). *F. Buchtienii* Hack. in Fedde, Rep. Sp. Nov. 6: 160 (1908). *F. Pflanzii* Pilger in Engler, Bot. Jahrb. 49: 188 (1912). Caespitose perennial, 4-10 dm. high, the involute pungent leaves glabrous or scabrid, occasionally equaling the inflorescence. Panicle narrow, the branches appressed or spreading, to 15 cm. long, the rachis and pedicels scabridulous. Spikelets to 1.1 cm. long, 3-4-flowered. Glumes unequal, the first to 4.5 mm. long, apically scabrid, the second to 7 mm. long, ciliate at base, apically scabrid. Lowest lemmas to 7 mm. long, awnless, scabrid toward apex, but otherwise glabrous. Palea as long as lemma or longer, bidentate, bicarinate, the keels minutely ciliate. LA PAZ: LARECAJA: vic. Sorata; Millipaya, 3700-4200 m., *Mandon* 1361 (GH); MURILLO: Palca, 3700 m., *Hitchcock* 22568 (GH); La Paz, 3300 m., *Bang* 33 (GH), 4100 m., *Buchtien* 428 (GH). COCHABAMBA: CERCADO: Cerro Molle-Molle, *Steinbach* 4093 (GH), 3800 m., *Steinbach* 4062 (GH); AYOPAYA: Tabacruz, 4200 m., *Steinbach* 9760 (GH); south side of Mt. Tunari, 3600 m., *Steinbach* 9787 (GH), 9784 (GH). POTOSÍ: SUR CHICHAS: Tupiza, 2700 m., *Fiebrig* 2955 (GH; type-number of *F. laeteviridis*).

7. *Aphanelytrum* Hack.

Aphanelytrum procumbens (Hack.) Hack. in Oesterr. Bot. Zeitschr. 52: 13 (1902). A straggling perennial, culms decumbent, sometimes stoloniferous, to 8 dm. high. Leaves glabrous, not scabridulous, much shorter than the inflorescence, the short acute blades about 3 mm. wide. Inflorescence a lax racemose panicle up to 2 dm. long, the very slender branches distant and bearing 2-3 spikelets at their ends. Spikelets about 1.2 cm. long, pedicellate, 2-flowered, the naked rachilla disarticulating above the glumes, the second floret distant from the first; glumes greatly reduced, minute; lemmas to 7 mm. long, long-acute but not awned, more or less hyaline, several-nerved, the nerves green; palea similar to the lemma but shorter, 1-nerved, the nerve green. LA PAZ: MURILLO: Unduavi, 3300 m., *Buchtien* 4268 (US); NOR YUNGAS: Bella Vista, *Hitchcock* 22756 (US).

8. *Puccinellia* Parl.

Perennials, low-growing, the more or less decumbent culms up to 20 cm. high. Leaves glabrous, short, very narrow, the uppermost blade on a culm equaling or sometimes exceeding the inflorescence and often enveloping its base. Inflorescence a short, dense, racemose panicle up to 12 cm. long, the branches erect, appressed, the pedicels often (or usually) short, thick, sulcate. Spikelets 2-3-flowered, all florets perfect, glumes present, the naked rachilla disarticulating above the glumes; lemma rounded, the nerves obscure, glabrous, but sometimes puberulent at the base, awnless.

Spikelets about 2 mm. long; lemma about 1 mm. long. 1. *P. parvula*.
Spikelets 4-5 mm. long; lemma about 2.5 mm. long. 2. *P. oresigena*.

1. *Puccinellia parvula* Hitchc. in Contrib. U. S. Nat. Herb. 24: 325 (1927). Spikelets 2-3-flowered. Glumes unequal, the first about 0.5 mm. long, the second, 1 mm. long. Lemmas elliptic-oblong, the apex obtuse or lacerate; palea about as long as the lemma. POTOSÍ: SUR CHICHAS: Atocha, 3300 m., *Hitchcock* 22878 (US; type).

2. *P. oresigena* (Phil). Hitchc. in Contrib. U. S. Nat. Herb. 24: 326 (1927). Spikelets 3-flowered. Glumes unequal, the first about 1 mm. long, the second, 1.5 mm. long. Lemmas acute. POTOSÍ: SUR CHICHAS: Atocha, *Hitchcock* 22879 (GH).

9. *Amphibromus* Nees

Amphibromus scabrivalvis (Trin.) Swallen in Amer. Journ. Bot. 18: 413 (1931). A rhizomatous perennial, the culms erect (the base sometimes decumbent), to 1 m. or more in height. Leaves glabrous, the lowest blade to 40 cm. long, the uppermost reduced, 2-6 mm. wide. Inflorescence a rather lax racemose panicle to 20 cm. long, the slender branches often spreading or drooping. Spikelets pedicellate, up to 7-flowered, the florets distant, the uppermost floret sterile, to 1.5 cm.

long (excluding the awns), the rachilla unilaterally short-villous, with an apical ring of hairs below each floret, disarticulating above the glumes. Glumes unequal, the first about 4 mm. long, the second, 5 mm. long, the apex erose. Lemmas about 7 mm. long, bifid to the middle or below, the 1.2 cm. twisted geniculate awn arising from the base of the sinus, up to 9-nerved, scabrid, the apices erose; palea shorter than the lemma, bicarinate. LA PAZ: MURILLO: La Paz, *Buchtien* 6422 (US).

10. *Poa* L.

Annual or perennial, one species dioecious. Culms usually but not always exceeding the leaves. Leaf-blades flat or involute, usually scabridulous beneath. Inflorescence a terminal racemose panicle, narrow and condensed or more open and spreading, the rachis and pedicels glabrous, puberulent or scabridulous, sometimes sparsely so. Spikelets 2-6-flowered, the glumes usually unequal, the glabrous or puberulent rachilla disarticulating above the glumes; fertile lemmas below the sterile lemma or rudiment.

- a. Plants dioecious. 1. *P. Buchtienii*.
- a. Plants not dioecious.
 - b. Dwarf plants, about 4 cm. high; glumes and lemmas subquadrate. 3. *P. humillima*.
 - b. Plants taller; glumes and lemmas not subquadrate.
 - c. Rachis and pedicels glabrous.
 - d. Spikelets to 6 mm. long, 4-5-flowered; annual. 9. *P. annua*.
 - d. Spikelets to 3 mm. long, 3-flowered; perennial. 10. *P. denticulata*.
 - c. Rachis and pedicels puberulent or scabridulous.
 - e. Spikelets subquadrate, as broad as long. 5. *P. Hieronymi*.
 - e. Spikelets longer than broad (but note no. 11).
 - f. Spikelets 2-flowered. 12. *P. candamoana*.
 - f. Spikelets almost always more than 2-flowered.
 - g. Lemmas not villous on any part.
 - h. First glume about 2.5 mm. long. 6. *P. Lilloi*.
 - h. First glume about 4.5 mm. long. 4. *P. gymnantha*.
 - g. Lemmas with at least basal villosity.
 - i. Rachilla puberulent. 8. *P. asperiflora*.
 - i. Rachilla glabrous.
 - j. Spikelets to 7 mm. long, often almost as broad as long. 11. *P. horridula*.
 - j. Spikelets 4-5 mm. long, definitely longer than broad.
 - k. Glumes equal or subequal. 7. *P. pratensis*.
 - k. Glumes unequal. 2. *P. scaberula*.

1. *Poa Buchtienii* Hack. in Fedde, Rep. Sp. Nov. 11: 29 (1912).
P. Buchtienii var. *subacuminata* Hack. in Fedde, Rep. Sp. Nov. 11: 30 (1912). Perennial, to 8 dm. high, the leaf-blades flat, to 3 mm. wide.

Rachis and pedicels scabrid. Staminate spikelets: about 5 mm. long, 3-5-flowered, the rachilla glabrous. First glume 2.5 mm. long, 1-nerved, the nerves scabrid, at least on the upper portion, the second glume about 3.5 mm. long, broader than the first, obscurely 3-nerved, the keel scabridulous. Lowest lemmas about 3.5 mm. long, obscurely nerved, the mid-nerve scabridulous on the upper part, the apex erose. Palea 3 mm. long, the 2 keels ciliolate. Pistillate spikelets: about 6-7 mm. long, 5-flowered, the rachilla glabrous. First glume about 2.5 mm. long, 1-nerved, the keel scabridulous, the second glume 3 mm. long, 3-nerved, the keel scabrid. Lowest lemmas about 4.5 mm. long, densely long-pilose at base and on the lower half of the keel, the apex erose to acute. Palea shorter than the lemma, the keels long-pilose below and ciliate above. LA PAZ: MURILLO: La Paz, 3700 m., *Buchtien* 2468 (GH); Palca, 3700 m., *Hitchcock* 22559 (GH), 22570 (GH).

One culm on the Gray Herbarium sheet of *Buchtien* 2468 bears staminate spikelets with the basal villosity of the pistillate spikelets.

2. *P. scaberula* Hook. f. Fl. Antarct. 378 (1847). Annual, to 5 dm. high, the leaf-blades to 2 mm. wide and scabrid beneath, the rachis and pedicels densely scabrous. Spikelets to 4 mm. long, about 4-flowered, the rachilla glabrous. Glumes 2 and 2.5 mm. long, the keels scabrid. Lowest lemmas 2.5 mm. long, villous at base and halfway up the keel, the lateral nerves often somewhat villous basally. Palea much shorter than the lemma, the keels ciliate. LA PAZ: LARECAJA: vic. Sorata; Lancha de Cochipata, 3000-3700 m., *Mandon* 1336 (GH); MURILLO: La Paz, 3670 m., *Buchtien* (GH).

3. *P. humillima* Pilger in Engler, Bot. Jahrb. 37: 378 (1906). Very dwarf, caespitose perennial, the leaf-blades hardly 2 cm. long, involute, glabrous, the panicle not over 1 cm. long, rachis and pedicels puberulent. Spikelets to 5 mm. long, 3-4-flowered, the rachilla glabrous. Glumes equal, 3.5 mm. long, subquadrate, apex coarsely and erosely toothed, obscurely 3-nerved. Lemmas about 4.5 mm. long, subquadrate, 5-nerved, the apex erosely toothed. Palea shorter than lemma, bicarinate. LA PAZ: LARECAJA: vic. Sorata; near Anilaya, 4500 m., *Mandon* 1353 (GH).

4 *P. gymnantha* Pilger in Engler, Bot. Jahrb. 56, Beibl. 123: 28 (1920). *P. perligulata* Pilger in Notizbl. 11: 779 (1933). *P. gymnantha* var. *aperta* Pilger in Notizbl. 11: 780 (1933). Caespitose perennial to 20 cm. high, leaf-blades flat or involute, glabrous, 5-10 cm. long, the panicles 3-7 cm. long, rachis and pedicels scabridulous-puberulent. Spikelets 5-7 mm. long, 2-3 (-4)-flowered. Glumes unequal, the first to 4.5 mm. long, 1-nerved, scabridulous at apex, the second to 5 mm. long, 3-nerved, scabridulous at apex. Lemmas acute to subacute, 5.5 mm. long, 5-nerved, the keel scabrid-ciliate, the rest

scabridulous. Palea as long as lemma, scabridulous, the 2 keels scabrid-ciliolate. LA PAZ: LARECAJA: vic. Sorata; Llachisani, 4200 m., *Mandon* 1348 (GH); Anilaya, 3500-4000 m., *Mandon* 1350 (GH), 3800-4200 m., *Mandon* 1351 (GH); MURILLO: vic. La Paz, 5000 m., *Mandon* 1352 (GH). COCHABAMBA: AYOPAYA: Tabacruz, 4200 m., *Steinbach* 9761 (GH).

5. *P. Hieronymi* Hack. in Oesterr. Bot. Zeitschr. 52: 380 (1902). *P. myriantha* Hack. in Stuckert in Anal. Mus. Nac. Buenos Aires, 13: 517 (1906). Perennial, to 2 m. high, leaf-blades scabrous, the flat blades 8-10 mm. wide, scabrous beneath, the very lax open panicle to 4 dm. long, the ultimate branches extremely filiform, the rachis and pedicels sparsely scabridulous. Spikelets subquadrate, to 5 mm. long and broad, 5-6-flowered, the rachilla glabrous. Glumes equal, about 5 mm. long, the first 1-nerved, the nerve scabrid, the margin scabrid-ciliolate, the second 3-nerved, the nerves scabrid. Lemmas acute, to 3.5 mm. long, the nerves scabrid, the margins ciliolate, a small tuft of tangled hairs at base of central nerve. Palea decidedly shorter than the lemma, the 2 keels ciliolate. COCHABAMBA: CHAPARE: Inca-chaca, 2700 m., *Steinbach* 8956 (GH), 2500-3000 m., *Steinbach* 9517 (GH).

6. *P. Lilloi* Hack. in Stuckert in Anal. Mus. Nac. Buenos Aires, 21: 153 (1911). Perennial, 10-20 (-30) cm. high, leaves glabrous, the very narrow blades involute, panicle 2-4 cm. long, rachis and pedicels scabrid, sometimes sparsely so. Spikelets about 5 mm. long, about 4-flowered, rachilla glabrous to slightly puberulent. First glume 2.5 mm. long, 1-nerved, the keel scabrid, the second glume to 3 mm., 3-nerved, scabridulous. Lemmas to 3.5 mm. long, 3-5-nerved, scabridulous, especially on the nerves. Palea nearly as long as the lemma, the 2 keels ciliolate. POTOSÍ: SUR CHICHAS: Atocha, *Hitchcock* 22931 (Hitchcock).

The description given is based on an isotype, *Lillo* 5619 (GH).

7. *P. pratensis* L. Sp. Pl. 67 (1753). *P. boliviensis* Hack. in Fedde, Rep. Sp. Nov. 11: 25 (1912). Rhizomatous perennial, to 5 dm. high. Leaf-blades to 3 mm. wide, glabrous or scabridulous beneath. Panicles to 10 cm. long, the rachis and pedicels scabridulous. Spikelets about 5 mm. long, 3-5-flowered. The rachilla glabrous or sparsely and minutely puberulent. Glumes subequal, about 3 mm. long, the keels scabridulous, the first 1-nerved, the second 3-nerved. Lowest lemmas about 3 mm. long, 5-nerved, the keel basally long-villous, the upper half scabrous, marginal nerves basally villous. Palea nearly as long as the lemma, the 2 keels ciliolate. LA PAZ: MURILLO: San Jorge, 3550 m., *Buchtien* 236 (GH).

8. *P. asperiflora* Hack. in Fedde, Rep. Sp. Nov. 11: 28 (1912). *P. Pflanzii* Pilger in Engler, Bot. Jahrb. 49: 187 (1912). Caespitose perennial to 5 dm. high, the involute leaf-blades sometimes exceeding

the inflorescence, scabrid. Panicles fairly open, generally 10 cm. or less in length, the rachis and pedicels scabridulous. Spikelets about 7 mm. long, 4-flowered, the rachilla puberulent. First glume about 3.5 mm. long, 1-nerved, the second glume about 5 mm. long, 3-nerved, the keel slightly scabridulous. Lowest lemmas about 5 mm. long, 5-nerved, the keel basally short-villous, with scattered pubescence on the lateral nerves. Palea about 4 mm. long, the keels ciliolate. LA PAZ: LARECAJA: vic. Sorata; Lacatia, 3360-4200 m., *Mandon* 1341 (GH); MURILLO: Pilaya, 4000 m., *Hitchcock* 22587 (GH).

9. *P. annua* L. Sp. Pl. 68 (1753). Annual, the leaf-blades to 3 mm. wide, sometimes scabridulous beneath, the panicles open, to 6 cm. long, the rachis and pedicels glabrous. Spikelets to 6 mm. long, 4-5-flowered, the rachilla glabrous to sparsely puberulent. First glume about 2.5 mm. long, 1-nerved, faintly scabridulous near the apex, the second glume 3 mm. long, 3-nerved. Lowest lemmas 3 mm. long, 5-nerved, the keel with few to many hairs at base and about halfway up, but not forming a basal cobweb. Palea nearly as long as lemma, bicarinate. LA PAZ: LARECAJA: vic. Sorata; Achacache, 2650-3950 m., *Mandon* 1335 (GH). COCHABAMBA: CERCADO: Cochabamba, 2600 m., *Steinbach* 8787 (GH); CHAPARE: Incachaca, 2250 m., *Steinbach* 9496 (GH). SANTA CRUZ: VALLEGRANDE: Cerro de San Mateo, Comarapa, 3400 m., *Steinbach* 8486 (GH).

10. *P. denticulata* Hack. in Fedde, Rep. Sp. Nov. 11: 27 (1912). Perennial, to 25 dm. high, leaf-blades 2-3 mm. wide, scabrid beneath. Panicles lax, to 8 cm. long, primary branches whorled, rachis and pedicels glabrous. Spikelets 4 mm. long, 3-flowered. Glumes 2 and 2.5 mm. long, the first 1-nerved, the second, 3-nerved. Lowest lemmas to 3 mm. long, ovate, obtuse, the apex erosely toothed, 5-nerved, the basal hairs reaching about one-third the length of the lemma. Palea as long as the lemma, bidentate, the keels scabridulous. LA PAZ: MURILLO: Unduavi, 3200 m., *Buchtien* 2584 (US; type-number).

11. *P. horridula* Pilger in Engler, Bot. Jahrb. 37: 506 (1906). *P. androgyna* Hack. in Fedde, Rep. Sp. Nov. 6: 159 (1908). *P. dumetorum* Hack. in Fedde, Rep. Sp. Nov. 11: 27 (1912). *P. dumetorum* var. *unduavensis* Hack. in Fedde, Rep. Sp. Nov. 11: 27 (1912). Perennial, to 1-1.5 m. high, leaf-blades to 8 mm. wide, scabridulous beneath. Panicle to 2 dm. long, the rachis and pedicels scabridulous. Spikelets to 7 mm. long, often about as broad as long, 4-5-flowered, the rachilla glabrous. First glume to 2.5 mm. long, 1-nerved, the nerve scabridulous, the second to 3 mm. long, 3-nerved, the nerves scabridulous. Lowest lemmas to 3.5 mm. long, 5-nerved, pilose on lower half of keel and along lower marginal nerves, the keel scabridulous on upper half. Palea as long as the lemma, the keels ciliate. LA PAZ: LARECAJA: vic. Sorata; Cochipata, 2700-3900 m., *Mandon* 1339 (GH); MURILLO: La Paz, *Buchtien* 846 (GH; type-number of *P. androgyna*), 3800 m., *Buchtien* 168 (GH); Unduavi, 3200 m., *Buchtien* 2583 (GH);

type-number of *P. dumetorum* var. *unduavensis*) ; NOR YUNGAS: Bella Vista, *Hitchcock* 22754 (GH).

12. *P. candamoana* Pilger in Engler, Bot. Jahrb. **37**: 381 (1906). Perennial, leaf-blades to 3 mm. wide, scabridulous beneath. Panicle to 15 cm. long, but usually much shorter, rachis and pedicels scabrid. Spikelets to 5 mm. long, 2-flowered, the rachilla sparsely villous. Glumes 3 and 4 mm. long, acute, the second much broader than the first. Lowest lemmas about 4 mm. long, villous on the lower half, the first floret sometimes not perfect but staminate. Palea shorter than the lemma, the keels ciliate. LA PAZ: MURILLO: La Paz, 3800 m., *Buchtien* 8536 (GH); NOR YUNGAS: Pongo, 3640 m., *Hitchcock* 22769 (GH).

Errata: Volume 67

- ✓ p. 351 line 22 *Daura* should read *Datura*
- ✓ p. 356 line 12 *Gleichenia* should read *Gleichenia*
- ✓ p. 368 Fig. 4 Caption should read Mean temperature for January in °F, (after Hare 1952)
- ✓ p. 372 line 27 *sessiliflora* should read *sessilifolia*
- ✓ p. 373 line 13 *macrocarpa* should read *macrocarpon*
- ✓ p. 409, 411 running head *thyoites* should read *thyoides*

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CONTENTS:

- New Data on North American Oak Ferns, *Gymnocarpium***
Warren H. Wagner, Jr. 121
- Lactuca muralis* in New England** *James P. Poole* 138
- Cuchumatanea A New Genus of Compositae (Heliantheae)**
C. E. Seidenschnur and J. H. Beaman 139
- Seed Germination of *Shortia galacifolia* T. & G. Under
Controlled Conditions** *Mary H. Rhoades* 147
- The Application of the Linnaean Names of Some New
World Species of *Euphorbia* Subgenus *Chamaesyce***
Derek Burch 155

(Continued on Inside Cover)

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CONTENTS: — *continued*

Identity of Witchweed in the Southeastern United States <i>C. Earle Smith, Jr.</i>	167
Bromus mollis and Allies in New England <i>Frank C. Seymour</i>	168
Contribution to the Fungus Flora of Northeastern North America. IV <i>Howard E. Bigelow and Margaret E. Barr</i>	175
Notes on Rafinesque's Species of Lechea (Cistaceae) <i>Robert L. Wilbur</i>	192
Gentiana puberulenta sp. nov., A Known but Unnamed Species of the North American Prairies <i>James S. Pringle</i>	209
New Chromosome Numbers in Zinnia and Sanvitalia <i>Andrew M. Torres</i>	215
Two New Naiads from Illinois and Distributional Records of the Naiadaceae <i>Paul L. Fore and Robert H. Mohlen- brock</i>	216
Aquatic Vascular Plants New for Illinois <i>Glen S. Winterringer</i>	221
Studies in the Flora of Bolivia-IV (Continued) <i>Robert C. Foster</i>	223

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NEW DATA ON NORTH AMERICAN OAK FERNS, GYMNOCARPIUM

WARREN H. WAGNER, JR.¹

The oak ferns, *Gymnocarpium* Newman, include few taxa. Except for one or more separate and endemic elements in eastern Asia (cf. Pichi-Sermolli, 1965. p. 148), there are only two basic species over most of the circumboreal range. Nevertheless, there are controversial points regarding both the generic treatment and the species taxonomy. The common oak fern, *Gymnocarpium dryopteris* (L.) Newman has broadly triangular leaf blades with the axes so sparsely glandular that they are usually designated as "glabrous." The "limestone" oak fern, *G. robertianum* (Hoffm.) Newman, is far rarer and more sporadic in most of its range. It has narrower leaf blades, and the blade axes (and the lamina) are densely glandular. Both of these ferns are variable, both in habitat and morphology. Dwarfed plants of *G. robertianum*, especially those growing on dryish rock cliffs, may tend to mimic the leaf outline of *G. dryopteris*. Fully developed, however, the characteristics of

¹Research supported by National Science Foundation Grant GB-2025. I wish to acknowledge the aid of Miss Sandra Smith and Mrs. Katherine Lim Chen, and the suggestions of Doctors E. T. Wherry, Eric Hultén, and Conrad V. Morton. The following herbaria kindly lent materials: Cranbrook Institute of Science, Gray Herbarium, Missouri Botanical Garden, U. S. National Museum, and the Naturhistoriska Riksmuseet, Stockholm. Dr. J. H. Soper made it possible for me to study the oak ferns in the herbarium at the University of Toronto.



PLATE 1328

Fig. 1. *Gymnocarpium dryopteris* var. *disjunctum*. Voucher specimen, $n = 40$, Wagner 63087 and Kruckeberg (MICH).



PLATE 1329

Fig. 2. *Gymnocarpium heterosporum* n. sp. Type specimen. Wagner 283 (MICH).

these plants are distinctive and most authors have upheld them as separate species. Good keys and brief descriptions are found in familiar manuals and guides (e.g., Tutin et al., 1964; Wherry, 1961); and the taxonomic characters are fairly well established.

At least two recent writers (Lawalrée, 1950; and Boivin, 1962) have questioned whether the two widespread taxa are specifically different. This question will be discussed further below. Also, there has been some disagreement about the generic placement of the oak ferns, but this matter will not be dealt with. Suffice it to say, the combination of characters does seem very well-marked, and in the past few years there has developed a widespread tendency to recognize *Gymnocarpium* as a distinct genus. The question is what its relationships are. The base number of $x = 40$ is quite different from such thelypteroid ferns as *Phegopteris* ($x = 30$), *Cyclosorus* ($x = 36$), and such species of *Thelypteris* as *T. palustris* ($x = 35$) and *T.*

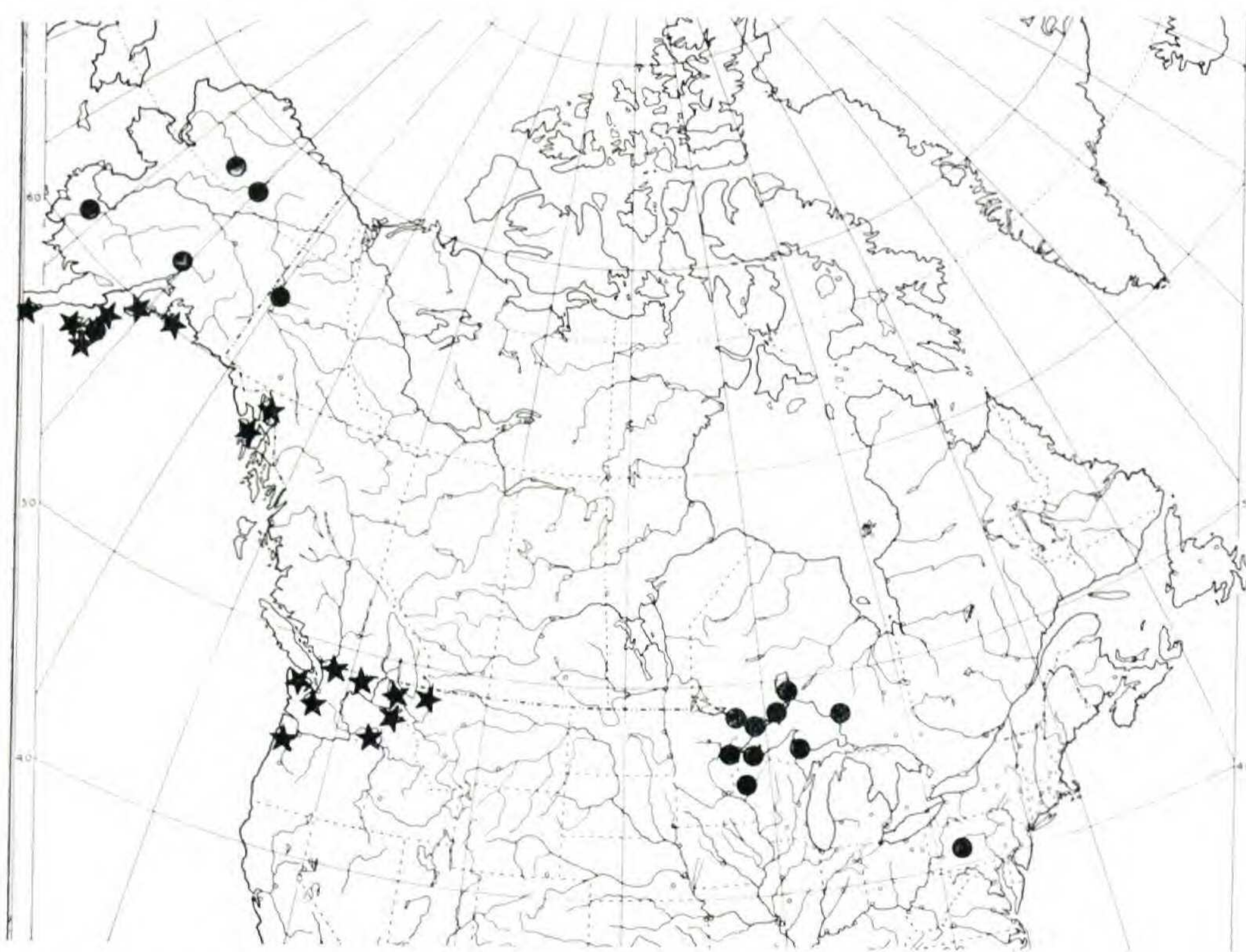


Fig. 3. Distribution map. Stars = very small spored *G. dryopteris* (less than 23.9×1.18 microns). Dots = *G. heterosporum*.

noveboracensis ($x = 27$). The chromosome number of *Gymnocarpium* resembles that of typical aspidioid ferns (e.g., *Dryopteris*, *Cystopteris*, *Polystichum*, *Tectaria*, *Ctenitis*, etc.) with $x = 40, 41$, or 42 .

Elizabeth Root (1961) studied intermediates between *G. dryopteris* and *G. robertianum* and pointed out, for the first time, that "the majority of the spores of all intermediate specimens were found to be abortive." Since her study we have learned that the "hybrid" *Gymnocarpium* is much more frequent and widespread than had been heretofore realized, as is illustrated in the map (Fig. 3, dots). We have also discovered that there are three ploidal levels present in North American *Gymnocarpium* — the diploid, triploid, and tetraploid. These facts will be examined below in connection with the following questions: Are *G. dryopteris* and *G. robertianum* distinct species? Should the western representative of *G. dryopteris* be recognized as a separate variety or subspecies? What is the nature of the plants which are morphologically intermediate between *G. dryopteris* and *G. robertianum*?

THE DISTINCTNESS OF *G. DRYOPTERIS* AND *G. ROBERTIANUM*

Boivin (op. cit.) is the most recent worker who endeavored to interpret taxon *robertianum* as merely a variety of *G. dryopteris*. He did not find it possible to uphold taxon *robertianum* as a species because "Tous les caractères donnés chevauchent largement, sauf celui de la glandulosité qui est assez net si l'on excepte 6 ou 8 spécimens (sur environ 200 examinés). Cette glandulosité est si fine et ces deux espèces sont si semblables que, sur une cinquantaine de spécimens glanduleux examinés, un bon quart étaient méso-identifiés." I should point out that herbarium collections of ferns are often misidentified. The fact that certain species (e.g., in *Gymnocarpium*, *Dryopteris*, and *Botrychium*) are commonly misidentified should not be used as a basis for taxonomic judgments.

The reasons for upholding *G. robertianum* as a distinct species, rather than a variety of *G. dryopteris*, fall into two

classes: (1) The morphology of well-developed specimens is unquestionably distinct, including characters of the overall blade outline, the details of segment form, and the glandularity. Small, ecologically depauperated or juvenile, specimens may of course cause difficulties if only gross characters are used. But the glandularity of *G. robertianum* is evidently always a dependable character. (Some of the problems of detecting the extent of glandularity in these plants could be alleviated by eliminating the unfortunate herbarium practice of pasting down fronds, thus coating the delicate glands with a thin "varnish" which makes them practically invisible.) The only really intermediate plants in respect to glandularity are those to be discussed below, but these plants are intermediate in other respects also between *G. dryopteris* and *G. robertianum* and they are probably of hybrid origin. (2) The second reason for upholding *G. robertianum* is simply the behavior of the natural populations. The two species grow together in numerous localities in the Great Lakes area, in exactly the same habitats and growth conditions, and their distinctness is immediately evident to the field worker. The fact that these two taxa can exist together sympatrically without merging, and the fact that there is no genomic difference (both have $n = 80$ in this region) in ploidal level, shows that using the varietal rank to express their relationships would be stretching that category too far (cf. Wagner, 1960). The differences between these ferns are best seen in the rich, shady swamps of northern Michigan where they develop to the maximum size in the luxuriant, moist conditions. Mixed populations are well known in several localities near the University of Michigan Biological Station (Cheboygan, and nearby Presque Isle Cos., Michigan).

GYMNOCARPIUM DRYOPTERIS VAR. DISJUNCTUM

The western North American representatives of *G. dryopteris*, especially in Idaho, Oregon, Washington, U.S.A. and British Columbia, Canada, tend to develop unusually large fronds. The area is roughly that shown by the stars

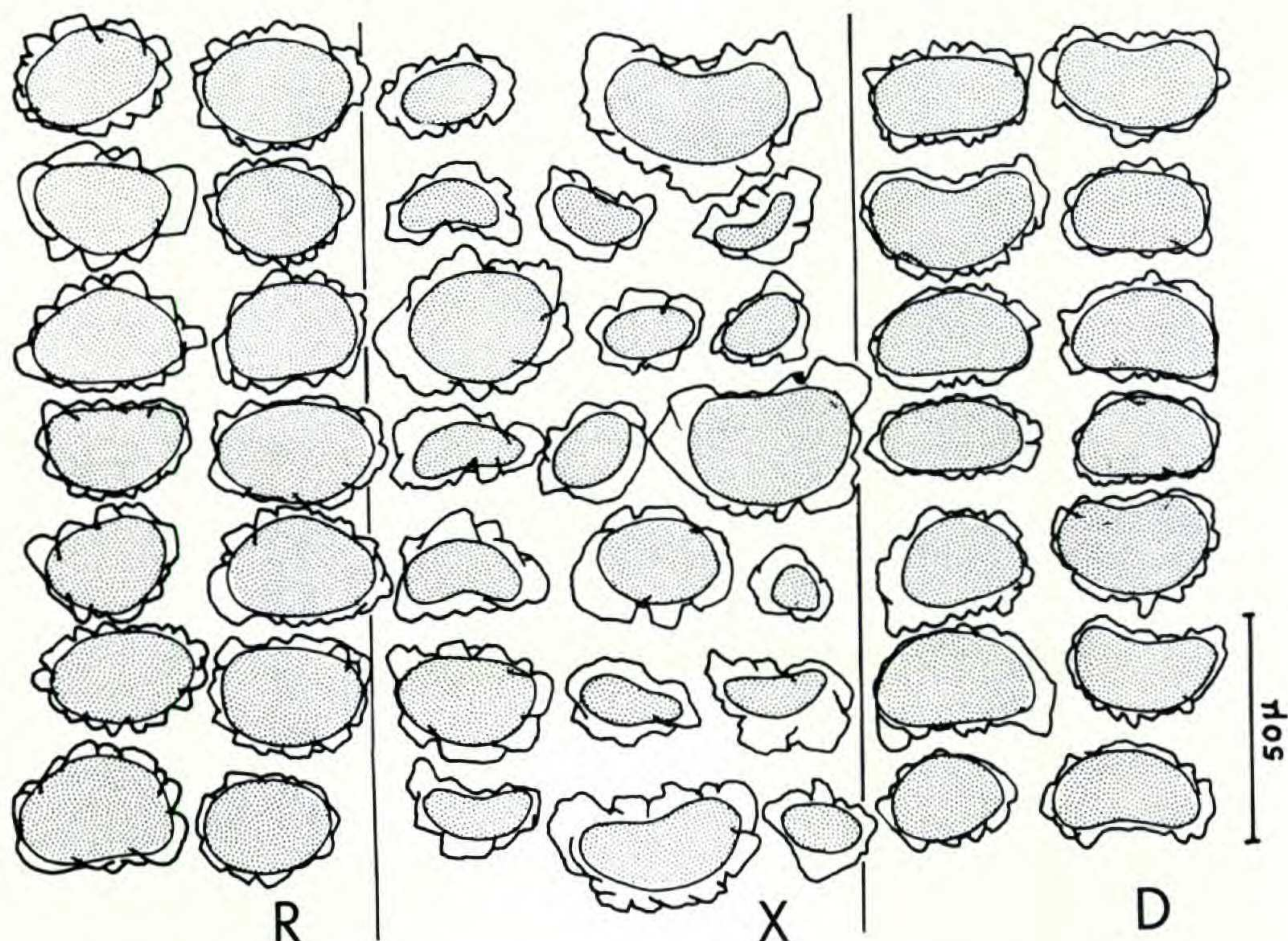


Fig. 4. Tracings of spores. Inner line = exospore; outer line = perispore. R. *Gymnocarpium robertianum*, Mich., Voss 4709 (MICH). X. *G. heterosporum*, Pennsylvania, Darling in 1956 (MICH). D. *G. dryopteris*, Mich., Voss 4708 (MICH).

of especially small-spored plants in Figure 3. In the most extreme form these plants become thrice-pinnate and the larger segments are more toothed than in typical *G. dryopteris*. Under the guidance of Dr. Arthur R. Kruckeberg of the University of Washington, I had an opportunity to study this form in the field. The best plants (Fig. 1) were seen in the deep coniferous woods at Denny Creek turnoff along U.S. 10, in the Snoqualmie National Forest, King Co., Washington. Here the "giant" *G. dryopteris* flourishes in damp, mossy forest with such other ferns as *Dryopteris dilatata* and *Athyrium filix-femina*, the latter two species also becoming remarkably large. Chromosome materials were obtained and squashes of meiosis showed clearly $n = 40$ pairs (Figs. 6 and 7, top illustrations). This is the first discovery of the diploid condition in the genus *Gymnocarpium*, all previous counts for which indicated the tetra-

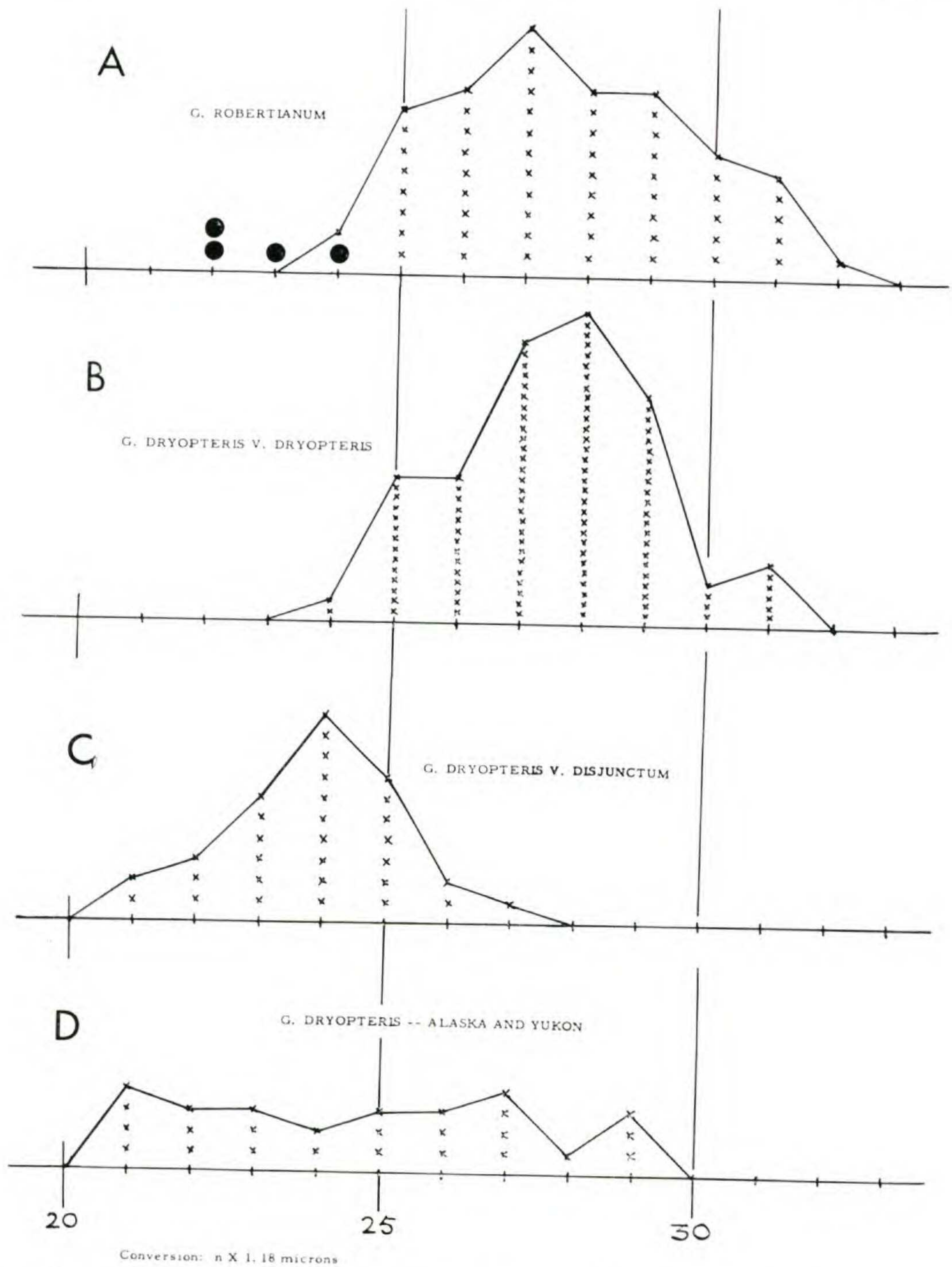


Fig. 5. Frequency histograms of spore lengths (exospore only). Each cross equals a 10-spore sample from a separate collection (Dots = spore samples of *G. continentale*). A. *G. robertianum*, all collections. B. *G. dryopteris*, all collections from Colorado east to Europe. C. *G. dryopteris*, all collections from British Columbia and Oregon east to Alberta and Montana. D. *G. dryopteris*, all collections from Alaska and Yukon. (Conversion: $n \times 1.18$ microns).

ploid condition of $n = 80$. (According to spore size, as shown in Fig. 5, A, the chromosome number of the Siberian *G. continentale* may also turn out to be diploid.)

For several reasons — the diploid chromosome number, the smaller spores (Fig. 5), the larger, more divided leaf (Fig. 1) and the distinctive western range — I choose (with some reluctance, however) to uphold the plants with this combination of characters as a separate variety. Morton (1941, p. 217) pointed out that the name *disjunctum* was based upon specimens from Sitka, Alaska, “and refers to certain large, lax forms that are essentially tripinnate, with the lower tertiary pinnules somewhat spaced out.” At the time of his writing, Morton was of the opinion that “they do not seem to be worth nomenclatural recognition . . .” Boivin (op. cit.), on the contrary, upheld the large form as a distinct variety.

Although I am inclined to agree now that var. *disjunctum* (Led.) Ching should probably merit recognition, I must point out that the situation becomes very complicated in Alaska and the Yukon, where both small- and large-spored types occur in the same general area (note the frequency histograms in Fig. 5, D). In this region also, we find numerous dwarfed individuals of both types, so that the gross appearance typical of “var. *disjunctum*” becomes modified and indistinguishable in many specimens from “var. *dryopteris*,” using the respective spore sizes as the criterion. Thus many specimens from the far northwest of North America cannot be readily identified. Dwarfing obscures the gross characters of the fronds; and the overlap of spore sizes between the diploid and tetraploid conditions is such that many specimens could not be identified without chromosome counts.

Our spore surveys have uncovered still other complications, the full meaning of which must await further study. It turned out that a number of collections of what I had interpreted to be ordinary “var. *dryopteris*” have abortive spores which in appearance match those of the presumed hybrid fern to be discussed below (like those in Fig. 4, ×).

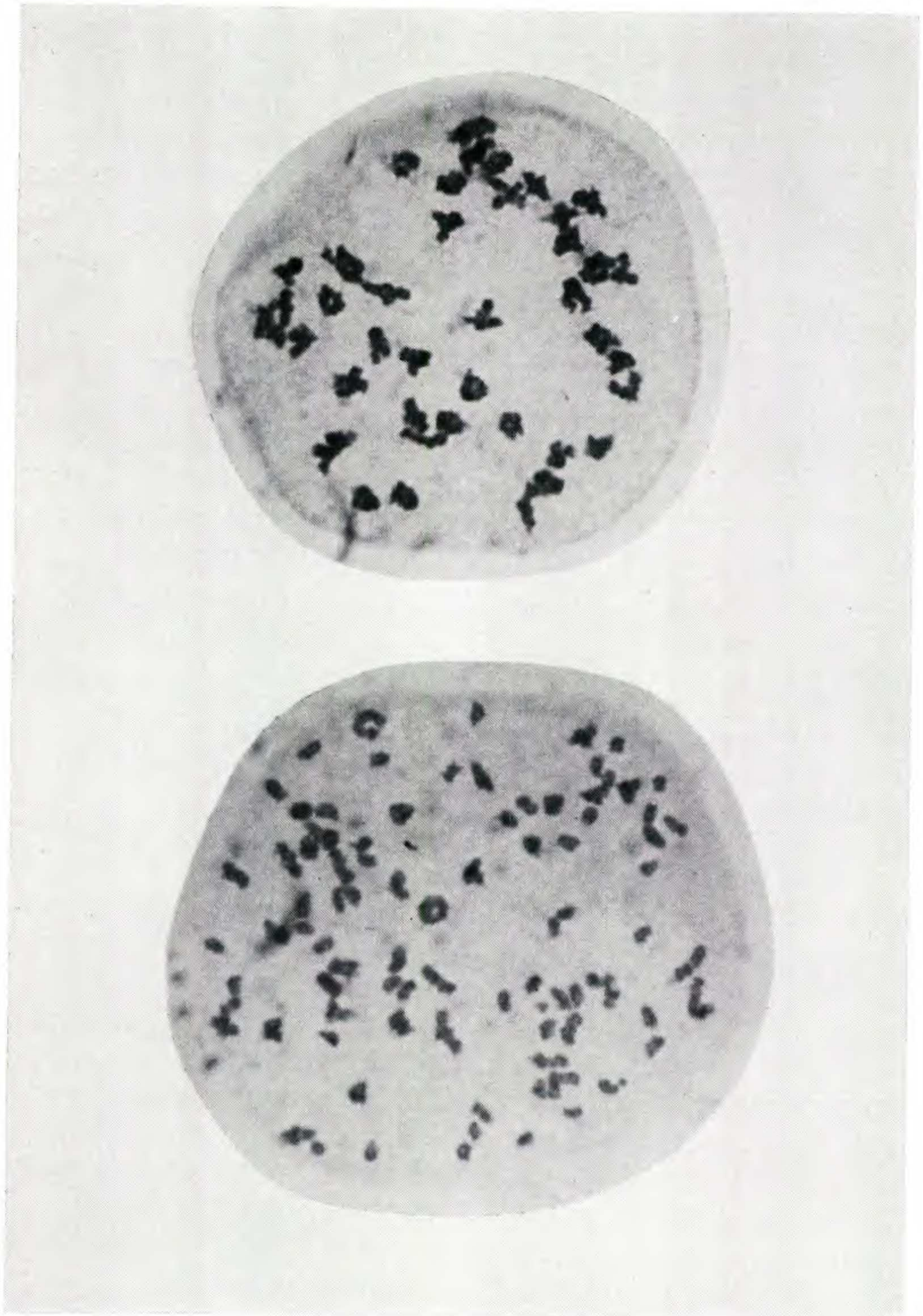


PLATE 1330

Fig. 6. New chromosome conditions in *Gymnocarpium*. Top: *G. dryopteris* var. *disjunctum* diploid, $n = 40$ pairs, Wagner 63087 and Kruckeberg (interpretation top left in Fig. 7). Bottom: *G. heterosporum* triploid, $3x = c. 120$, Wherry s.n., from Blair Co., Pennsylvania, in 1956 (bottom left in Fig. 7).



Fig. 7. Camera lucida interpretations of chromosome squashes. Top: Diploids, same locality as in Fig. 6. Bottom: Triploids, same locality as bottom photograph in Fig. 6.

Miss Virginia M. Morzenti kindly examined these collections and confirmed that the morphology of the abortion is very similar in the "sterile" *G. dryopteris* and the putative cross, *G. heterosporum*. It seems possible that at least some of these collections may be apomictic derivatives of *G. dryopteris* var. *disjunctum* (the diploid) $\times$ var. *dryopteris* (the tetraploid), assuming here, as elsewhere in this discussion, that the type of var. *disjunctum* corresponds to the diploid, large-leaved western plant. We failed to find a single example of *G. robertianum* in all those that we studied which showed a similar abortion of spores. Thus, if one argued that these "sterile" *G. dryopteris* plants might represent mutations that are propagated locally by rhizomes, we wonder why similar mutations were not found in the related *G. robertianum*. Those collections we found of presumably "sterile" *G. dryopteris* will not be enumerated in detail here, but their geographical distribution is extremely wide as shown by the following records: Alaska (2 collections), Alberta (1), British Columbia (1), Wisconsin (1), Michigan (5), New York (4), Vermont (2), Maine

(1), New Hampshire (1), Quebec (1), Newfoundland (2), and Nova Scotia (1). Further research on these curious "sterile" oak ferns with the morphology of *G. dryopteris* is greatly to be desired, especially to determine their cytological features and the mode of their reproduction.

THE APPARENT CROSS OF *G. DRYOPTERIS* AND *G. ROBERTIANUM*

This is the plant discussed by Root (op. cit.). As stated above, the apparent cross is much more frequent and widespread than we had previously realized. Its occurrence, especially in the western Great Lakes area, indicates that it is more than a rare hybrid, and I have concluded therefore that it should be given a binomial designation as an apomictic species, as follows:

***Gymnocarpium heterosporum* n. sp.** W. H. Wagner. Planta frondis segmentique forma et glandularitate intermedia inter *G. dryopteridem* et *G. robertianum*; spori atro-brunnei, magnitudine et forma valde irregulares.

Type: PENNSYLVANIA: BLAIR CO., Canaan Station, limestone slope, *W. H. Wagner 283* (transferred from University of Pennsylvania to MICH — 2 sheets, one fertile, the holotype (Fig. 2), and one sterile).

Representative Collections: U.S.A.: PENNSYLVANIA: BLAIR CO., 2 mi. n. w. of Hollidaysburg, among limestone rocks, *T. Darling, Jr.* in 1956 — same locality as the type (MICH). MICHIGAN: MARQUETTE CO., ca. 6 mi. n. w. of Ishpeming, near Ropes Gold Mine, n. w. $\frac{1}{4}$ sect. 29, T 46 N, R 27 W, in woods on igneous rock cliffs, *E. G. Voss 4707*, *W. H. Wagner* and *D. J. Hagenah 9415* (MICH). WISCONSIN: BAYFIELD CO., Orienta Falls, *G. H. Conklin* and *M. F. Somerville 1127* (WIS); BARRON CO., Barron Hills, just n. w. of Lehigh at the base of quartzite talus, *N. C. Fasset 15817* (WIS), *R. M. Tryon, Jr. 4154* (WIS, GH, MO). MINNESOTA: CARLTON CO., Carlton, Carlton-Thompson Gorge, St. Louis R., *M. F. Somerville* in 1928 (MICH); ST. LOUIS CO., observation tower at Ash River, *Wagner 9034.5a* (MICH); LAKE CO., Gooseberry Falls State Park, 15 mi. n. e. of Two Harbors, in crevice of diabase cliff, damp and shady, *R. M. and A. F. Tryon, A. C. Faber 4889* (MO); 45 mi. n.e. of Two Harbors, Manitou Falls near Lake Superior, under ledge of diabase, damp and shady, *R. M. and A. F. Tryon, A. C. Faber 4895* (MO). CANADA: ONTARIO. ALGOMA DISTRICT, rocky cliffs at edge of Soulier Lake, vicinity of Michipicoten Harbor, *R. C. Rosie, H. M. Harrison, E. O. Hughes 1092* (TRT, GH). ONTARIO, THUNDER BAY DISTRICT, 1 mi. n. of Little Pigeon Bay, Crooks Twp., talus slope, mostly shale, common, *C. E. Garten 1933* (TRT); ca. 19 mi. n. of Nipigon, spruce-fir thickets on damp moss-covered talus

at foot of cliff, *E. G. Voss 10335* (MICH, TRT); 15 mi. e. of Port Arthur, 2 mi. w. of Silver Islet, shady sandstone talus, *R. M. and A. F. Tryon, A. C. Faber 4963* (MO). U.S.A.: ALASKA: WISEMAN, on Middle Fork of the Koyukuk River, ca. 67° 30' N, 150° W, *Edith Scamman 913* (GH).¹

This fern, being intermediate between the two familiar species of *Gymnocarpium*, and having obviously peculiar spores might more appropriately be designated as merely a sporadic hybrid (e.g., as *G. dryopteris* × *robertianum*). There are several reasons why this was not done. (1) The plants develop large colonies locally, and behave as an apomictic species. (2) As shown on the range map (Fig. 3) plants conforming to this description run from Alaska southeast through the western Great Lakes area (the region, evidently, of its greatest abundance) down to central Pennsylvania. (3) Cytogenetically (see below) at least one population, the type, is triploid, and not tetraploid as would be expected from our present knowledge of the parents as they occur in the eastern United States. The nearest diploids (judging from spore sizes and assuming correlation with the single diploid count) seem to be limited to the western part of the continent. (4) Finally, the intermediate is evidently to be found in at least some localities where one of the putative parents (*G. robertianum*) is unknown.

The holotype, but not the cotypes, of *Dryopteris linnaeana* C. Chr. f. *glandulosa* R. M. Tryon, Jr. (Amer. Fern Jour. 29: 5, 1939) is evidently the same as the plant described above. The author wrote of his new "form" that the "rachis varies in glandularity, some specimens having only a few glands, while others have relatively many and rarely the blade is slightly glandular." Judging from the specimens cited, the author included two kinds of populations — the form of *G. dryopteris* in which the glands are more frequent and conspicuous than usual, and the plant described above. As to the glandular form of *G. dryopteris* itself, I am not sure that it is worthy of recognition. In her survey (1961, p. 18) Mrs. Root concluded that "It is generally stated that

¹Additional collection localities not cited here but plotted in Fig. 3 were supplied by Dr. Eric Hultén.

the fronds and rachises of *G. dryopteris* range from glabrous to rarely slightly glandular. However, upon close examination of specimens from various localities it was found that *every* individual of this species examined has glands." In synonymizing "forma *glandulosa*" with *G. robertianum* (as "*G. dryopteris* var. *pumilum* (DC) Boivin"), Boivin (1962) was in error. Neither the type nor the cotypes of Tryon's form conform to the characters of *G. robertianum*.

Specimens of *G. heterosporum* in herbaria have previously been determined as one or the other of the putative parents, but most commonly as "*G. robertianum*" or "*G. dryopteris* f. *glandulosa*." The recognition of *G. heterosporum* is usually fairly easy in herbarium material, so long as the specimens have ripe spores. These tend to be discharged and to lie around the axes of the frond, sticking to the sheet. If the spores appear blackish and strongly irregular in size and shape, this is an excellent diagnostic feature, in combination with the presence of the intermediate condition of glandularity. The spores can be seen even with a dissecting microscope or a high power hand lens; and once their appearance is learned it becomes easy to pick out other collections with the same spore conditions, so a compound microscope is unnecessary. The spores of typical specimens of *G. robertianum* and *G. dryopteris* seem always to have a "glassy," tan or brownish color, and are strikingly regular. Both the soriferous specimens, as well as those which lack sori, of the intermediate oak fern will show the intermediate glandularity of the axes, especially on the upper parts of the rachis (if they have not been imbedded in herbarium paste). The glands of *G. heterosporum* are fewer and more widely spaced than they are in the densely glandular *G. robertianum*. In the field it is helpful to hold up the living fronds in the sun's rays and examine them with a good hand lens. The glands will glisten and thus be conspicuous, so that even small, sterile fronds of all three taxa, if growing together, may be separated.

Wherry (1942) described the habitat of the type population as follows (*italics mine*): "... the base of a steep

northwest-facing wooded slope, above a brook, the underlying rock being *limestone* which breaks into small angular blocks, from the crevices of which moisture oozes out, and by evaporation keeps the rocks cool." The Michigan station near Ishpeming, Marquette Co., is on steep shaded rock cliffs. In the latter area, the rocks contain serpentine. Garten took his specimens on a talus slope comprising mostly shale. The Lake Co., Minnesota, material was recorded from crevices of a "diabase cliff," while that from Barron Co., Wisconsin, came from "quartzite talus." The specimens from east of Port Arthur, Ontario, were found on "shady sandstone talus." Thus, ecologically, the substratum itself does not seem to matter much. The constant features of the habitats of *G. heterosporum* seem to be (a) shadiness, (b) moisture and humidity, (c) presence of rock substratum of some kind, the plants growing either directly from crevices of cliffs or upon the fallen talus. One or both of the presumed parental species may be present at the same locality.

CHROMOSOMES AND SPORES

The chromosomes and spores seem to have significance in this group of plants because of their variability and their correlation with each other and with other systematic data such as distribution and morphology of the fronds. There are three chromosome conditions. The tetraploid with $n = 80$ or near that number is characteristic of *G. robertianum* as found by Manton and myself (Chiarugi, 1960; Fabbri, 1963). Judging from spore sizes (see Fig. 5) all populations of *G. robertianum* are probably tetraploid and the curve is normal. In Siberia, however, the rather similar *G. continentale* (Petrov) Pojark. has small spores (indicated by dots in the graph) and may be a diploid.

For *G. dryopteris* we first plotted all spore size averages and produced a broad, apparently undifferentiated curve. However, when we selected specimens from the area of presumably typical var. *disjunctum* (where we know there are diploids) an entirely different curve separated out. This area extends from British Columbia and Oregon east to

Alberta and Montana, and the spore sizes average between $23\text{-}25 \times 1.18$ microns¹ (Fig. 5, C) in maximum exospore diameter, in contrast to between $27\text{-}29 \times 1.18$ microns for var. *dryopteris* east of Colorado and including Europe (Fig. 5, B). Thus in *G. dryopteris* there is a correlation between spore size and polyploidy, as has been found in a number of other fern groups.

The "sterile-spored" *G. dryopteris* commented upon above may represent triploid populations, derived by interploidal hybridization and spreading by some means of spore dissemination not yet fully understood. The question is where the diploid and tetraploid may meet geographically. The graph of spore samples from Alaska (Fig. 5, D) shows values all the way from 21 to 29 micrometer units, strongly indicating that in this area, *G. dryopteris* is a mixture of ploidal levels.

It was extremely interesting to find that the type population of *G. heterosporum* (lower illustrations in Figs. 6 and 7) is triploid. Even though the pairing is very irregular, by totaling the estimated bivalents and univalents respectively of four sporocytes the following numbers resulted: (29) + 63, (33) + 50, (33) + 55, and (39) + 42. Their average was (33.5) + 52.5, or 119.5 chromosomes in all. Assuming that *G. heterosporum* is truly of hybrid origin and that both *G. dryopteris* and *G. robertianum* in the eastern U. S. are tetraploid, then it is possible that the type population originated as $2x$ *G. dryopteris* var. *disjunctum* $\times$ $4x$ *G. robertianum*. Further cytological surveys of *G. heterosporum* in other areas are highly desirable. It is possible that $4x$ forms of it exist.

I must alert collectors to the need of obtaining fertile materials of these plants of which the sori contain ripe spores. Out of 500 specimens that we examined, 150 proved to be sterile or too young for spore observations. Also, I should point out that it is not correct that the spores of

¹Conversion factor: one micrometer unit = 1.18 microns. Fig. 5 is plotted in micrometer units only, from spores taken from herbarium specimens and mounted directly in diaphane.

Gymnocarpium lack perispores. Ching's description of "spores bilateral, warty, and without perispore" (quoted in Morton, 1941) surely does not conform to our observations. As shown in the spore tracings in Figure 4, there are two clearly defined layers — the outer, perisporial covering which is irregular, and the inner, exosporial boundary which is smooth. This is not different from other members of this group of ferns associated with *Thelypteris* and *Dryopteris*. The perispores of *Gymnocarpium* show up especially well in the abortive spores of "sterile *G. dryopteris*" and of *G. heterosporum*, where they actually are more or less exaggerated in development. This excessive perisporial thickness is probably the factor which produces the darker, nearly black, appearance of the spores as seen en masse.

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REFERENCES CITED

- BOIVIN, BERNARD 1962. Etudes ptéridologiques. II. *Gymnocarpium* Newman. Bull de la Soc. bot. France **109** (nos. 5-6): 127-128.
- CHIARUGI, ALBERTO 1960. Tavole cromosomiche delle Pteridophyta. Caryologia **13** (no. 1): 27-150.
- FABBRI, FERNANDO 1963. Primo supplemento alle Tavole cromosomiche delle Pteridophyta di Alberto Chiarugi. Caryologia **16** (no. 2): 237-335.
- LAWALRÉE, ANDRE 1950. Ptéridophytes. In Flore Générale de Belgique. Jardin Bot. de l'Etat, Brussels.
- MORTON, C. V. 1941. On the name of the oak fern. Rhodora **43**: 216-219.
- PICHI-SERMOLLI, RODOLFO E. G. 1965. Index filicum, suppl. IV. Intern. Bur. Pl. Tax. and Nomencl., Utrecht.
- ROOT, ELIZABETH EICHSTEDT. 1961. Hybrids in North American *Gymnocarpiums*. Amer. Fern Jour. **51** (no. 1): 15-22.
- TRYON, ROLLA M., JR. 1939. Notes on the ferns of Wisconsin. Amer. Fern Jour. **29** (no. 1): 1-9.
- TUTIN, T. G. et al. (eds.) 1964. Flora europaea. Vol. I. Lycopodiaceae to Platanaceae. Cambridge Univ. Press.
- WAGNER, W. H. JR. 1960. Evergreen grapeferns and the meanings of infraspecific categories as used in American pteridophytes. Amer. Fern Jour. **50** (no. 1): 32-45.

WHERRY, EDGAR T. 1942. The ferns and lycosperms of Pennsylvania. *Bartonia*, no. 21: 11-63.

——— 1961. The Fern Guide. Northeastern and Midland United States and Adjacent Canada. Doubleday and Co., Garden City, N.Y.

LACTUCA MURALIS IN NEW ENGLAND

Recently a number of duplicates from a collection of New Hampshire plants by Andrew P. Nelson, Assistant Professor of Biology at Dartmouth College, were sent to Professor Albion R. Hodgdon at the University of New Hampshire. Among these was a specimen of *Lactuca muralis* (L.) Gaertn. (A. P. Nelson 1059) that was collected by the side of a gravel road between Cornish Mills and Plainfield in the town of Cornish, Sullivan County, N. H. on August 6, 1964. Professor Hodgdon states that this is the first report for this species in New England. Gray's Manual, 8th edition, describes the species as growing on roadsides and in waste places, local, w. Que., and e. N. Y. to Mich. (Adv. from Eu.). In Gleason and Cronquist *Manual of Vascular Plants* (1963) it is listed as a native of n. Eu. now known from N. Y. and Que. Voucher specimens have been deposited in the herbarium of the New England Botanical Club, Cambridge, Mass. and in the Pringle Herbarium at the University of Vermont in addition to the specimens in the University of New Hampshire Herbarium and the Jesup Herbarium.

JAMES P. POOLE, CURATOR.

JESUP HERBARIUM, DARTMOUTH COLLEGE

CUCHUMATANEA
A NEW GENUS OF THE COMPOSITAE
(HELIANTHEAE)¹

C. E. SEIDENSCHNUR AND J. H. BEAMAN

Cuchumatanea Seidenschnur & Beaman, gen. nov.

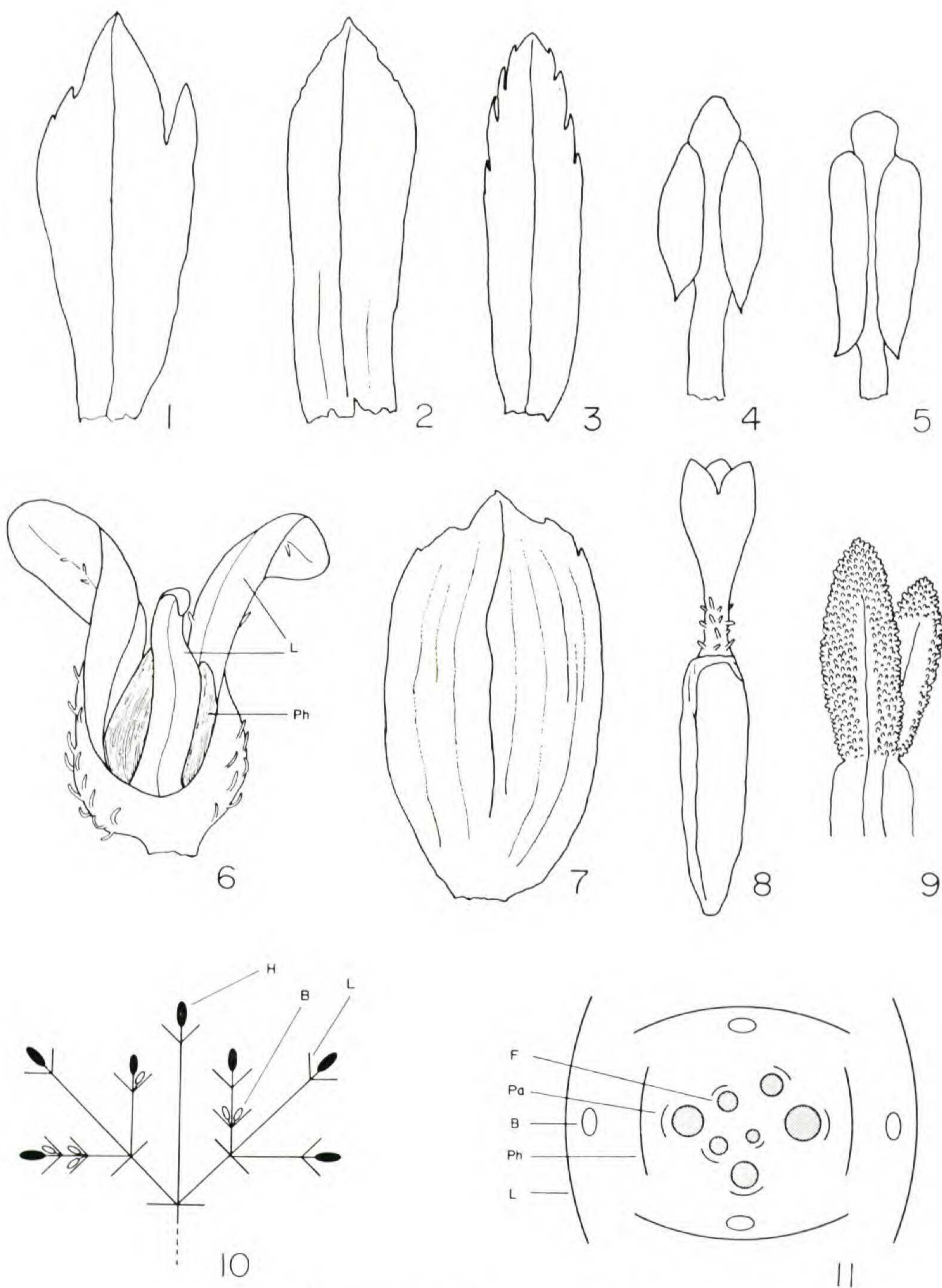
Herba annua, minuta, depressa. Folia opposita, spathulata, obscure trinervia, basi leviter connata. Rami oppositi ad nodos. Capitula homogama, sessilia vel subsessilia, terminalia, solitaria, cum pare foliorum clavato-spathulorum circumclusa. Phyllaria 2, late oblongo-ovata, basi subite attenuata, membranacea valde concava, laxe flosculos involventia. Receptaculum conicum, paleaceum, paleis membranaceis flosculos non amplexantibus, exterioribus oblongo-ovatis, interioribus gradatim angustioribus usque ad centrales lineares. Flosculi 5-10 in capitulo, hermaphroditi actinomorphi. Corolla anguste tubuloso-campanulata, 3-4 lobata, infra flava, sursum purpurea. Stamina 3-4, antheris connatis basi sagittatis, apice cum appendice late ovata vel suborbiculata ornata. Stylus infra ramos contractus, ramis oblongo-ellipticis, acutis, lato margine dorsoque dense papilloso. Achaenia ellipsoideo-oblonga deorsum paulo attenuata levissime compressa, striolata, brunneo-nigra. Pappus nullus.

Minute, depressed annual. Leaves opposite, spatulate, inconspicuously 3-veined, the bases slightly connate. Each node with two axillary branches. Heads homogamous, sessile or subsessile, solitary, terminal, surrounded by a pair of spatulate-clavate leaves. Phyllaries 2, broadly oblong-ovate, subpetiolate, membranaceous, strongly concave, loosely enclosing the florets, the outer oblong-ovate, the inner becoming progressively narrower, the innermost linear. Florets 5-10, hermaphroditic, actinomorphic. Corolla tubular, narrowly campanulate, 3-4 lobed, yellowish below, purplish above. Stamens 3-4, anthers connate, sagittate, with broadly ovate to suborbicular apical appendages. Style constricted just below the branches, the branches oblong-elliptical, acute, papillose to the base. Achenes ellipsoid-oblong, weakly compressed, brownish-black, striate. Pappus absent.

Cuchumatanea steyermarkii Seidenschnur & Beaman, sp. nov.

Herba annua, minuta, depressa usque ad 1 cm. alta, radice palari, saepe caespitosa. Caulis plus minusve sparse hirtellus vel glabratus,

¹The genus was discovered in the course of field work supported by National Science Foundation Grant G-9045. The research has been conducted in connection with NSF Grant GE-4051 for Undergraduate Research Participation. We are indebted to Dr. José Cuatrecasas for helpful suggestions and for preparing the Latin diagnoses and to Dr. D. C. D. De Jong for making the cytological preparations.



[Legend for figures 1-11]

Fig. 1-4, 6-11. *Cuchumatanea steyermarkii*, based on *Beaman 3962*.
 Fig. 5. *Jaegeria hirta*, based on *Beaman 4532*. Fig. 1-3. Pales (× 15).
 Fig. 4-5. Stamens (× 40). Fig. 6. Head and subtending leaves (× 7,
 L, leaf; Ph, phyllary). Fig. 7. Phyllary (× 15). Fig. 8. Floret with
 achene (× 20). Fig. 9. Style branches (× 75). Fig. 10. Diagram of
 a terminal portion of the branching system (B, bud; H, head; L, leaf).
 Fig. 11. Diagram of a head with subtending leaves (B, bud; F, floret;
 L, leaf; Pa, pale; Ph, phyllary).

viridis vel purpurascens composite dichasiale ramosus. Folia opposita decussata, basi paulo connata, saepe in pare inaequilonga, 3-7 mm longa 0.8-3 mm lata, spathulata, integra, margine parce revoluta sparse ciliata, 3-nervata sed nervis plerumque inconspicuis, supra glabra, subtus praecipue in nervo medio sparse pubescens. Capitula homogama, sessilia vel subsessilia, terminalia, solitaria, campanulata, circa 2 mm alta 1 mm lata, cum duobus foliis brevibus clavato-spathulatis amplexantibus, 2-3 mm longis 1.2 mm latis, adpresse subtendentia partimque tecta. Phyllaria 2 circa 2.5 mm longa 1.5 mm lata plerumque inaequilonga, oblongo-ovata basim angustata, membranacea sed apice recurva herbacea leviter lacerata, 3-venulosa, dorso ad venulam mediam parvis pilis, valde concava, laxe flosculos involventia. Receptaculum 0.2-0.5 mm altum, conicum, paleaceum. Paleae membranaceae persistentes flosculos non involventes, 1.5-2 mm longae, vena media conspicua aliquando 2-3 venulis lateralibus fere inconspicuis, glabrae, sursum margine minute laceratae deorsum integrae, exteriores oblongo-ovatae, ceterae gradatim angustiores usque ad centrum lineares. Flores omnes hermaphroditi, 5-10, plerumque 7 in capitulo. Corolla tubulosa 1 mm longa, limbo subcampanulato, 3-4 lobato, lobis ovatis acutis purpureis glabrisque, tubo 0.5 mm longo flavo, sparse pilosulo. Stamina 3-4 non semper pari quam corollae lobi, antheris basi sagittatis, apice appendice ovata vel suborbiculata, thecis 0.4 mm longis parietibus crassis. Stylus infra lobos constrictus, ramis oblongo-ellipticis, acutis, marginibus dorsoque papilloso, uno saepe quam altero longiore. Achaenia 1.1 mm longa, ellipsoideo-oblonga, basim versus attenuata, levissime compressa, basi obtusa, brunneo-nigra, striata, glabra. Pappus nullus. Chromosoma $n = 8$.

Minute, depressed, taprooted annual herb, 1 cm or less high, occurring in patches and tending to form open mats. Stems glabrate to sparsely hirtellous, greenish or purplish, with two axillary branches at each node, one branch system arising from each leaf axil. Leaves opposite, decussate, 3-7 mm long, 0.8-3 mm wide, one member of each pair usually larger than the other, spatulate, entire, the bases slightly connate, margins sparsely ciliate, somewhat revolute, with 3 inconspicuous veins, glabrous adaxially, sparsely pubescent mostly on the midvein below. Heads homogamous, sessile or subsessile, solitary, terminal, campanulate, ca. 2 mm high and 1 mm wide, closely subtended and partly covered by a pair of small spatulate-clavate leaves 2-3 mm long and 1.2 mm wide. Phyllaries 2, ca. 2.5 mm long, 1.5 mm wide, one usually larger than the other, oblong-obovate, narrowing basally, mostly membranaceous but with herbaceous reflexed tip, lacerate near the apex, 3-veined, with a few hairs abaxially on the median vein, strongly concave, loosely enclosing the florets. Receptacle 0.2-0.5 mm high, conical, paleaceous. Pales membranaceous, not surrounding the florets, 1.5-2 mm long, 1-veined, sometimes 2-3 incon-

spicuous lateral veins present, glabrous, minutely lacerate above, entire below, the outer oblong-ovate, the inner becoming progressively narrower, linear at the center of the head, persistent. Ray florets absent. Disk florets 5-10, commonly 7, hermaphroditic. Corollas tubular, narrowly campanulate, ca. 1 mm long, with 3-4 ovate acute lobes, tube 0.5 mm long, yellow, sparsely pilose, limb and lobes purplish, glabrous. Stamens 3-4, usually of the same number as the corolla lobes, anthers connate, sagittate, with broadly ovate to suborbicular apical appendages, thecae 0.4 mm long, with thick walls. Style constricted just below the branches, style branches oblong-elliptical, acute, papillose to the base, one branch often longer than the other. Achenes 1.1 mm long, ellipsoid-oblong, weakly compressed, with an obtuse base, brownish-black, striate, glabrous. Pappus absent. Chromosome number $n = 8$, based on *Beaman 3962*. Fig. 1-11.

GUATEMALA. HUEHUETENANGO: Sierra de los Cuchumatanes, ca. 3 kms south of road between Llano de San Miguel and Todos Santos, from a point 2.5 miles west of Llano de San Miguel, near the highest point in the Cuchumatanes, collected from about the 3,680 to 3,740 meter level, in open *Pinus rudis* forest, occurring in patches in black soil near limestone outcrops, frequent in a local area, 2 August 1960, *J. H. Beaman 3962* (MSC 171943, holotype; F, GH, K, TEX, UC, US isotypes); vicinity of Chémal, summit of Sierra de los Cuchumatanes, 3,700-3,750 m, *Steyermark 50260* (F).

The existence of this remarkable tiny plant was first pointed out by Dr. Julian A. Steyermark to Beaman in connection with the planning of a collecting expedition to Guatemala in 1959. Dr. Steyermark found it on August 8, 1942, in the vicinity of Chémal, Sierra de los Cuchumatanes, Department of Huehuetenango, Guatemala. In his field book he noted that it was annual, with the corolla yellow, the leaves green and shining, fleshy, fairly membranaceous, growing in bunches and patches. His collection was subsequently examined by Dr. S. F. Blake who suggested to Steyermark that it probably represented a new genus near *Jaegeria* or *Schkuhria*. Blake pencilled on the sheet: "Jaegeria? Material too scanty & depauperate." In early August, 1959, and late July, 1960, Beaman made unsuccessful searches for the species in the vicinity of Chémal. But on August 2, 1960, it was discovered a few kilometers southwest of Chémal in one of the highest and most remote regions of the Cuchumatanes. In publishing the species it is a pleasure to associate the name of Dr. Steyermark with

that of the Sierra de los Cuchumatanes. He has been the leading contributor to the understanding of the exceptionally diverse and unusual flora of this mountain range.

Cuchumatanea steyermarkii is an extremely reduced species, especially characterized by reduction of the plant body and of the florets. There is also slight asymmetry of the pairs of axillary branches, leaf and phyllary pairs, and style branches, with one member of each pair generally somewhat smaller than the other. In spite of reduction in size, however, the species has retained a complex branching system (see fig. 10). Two branches generally arise from each of the 3-4 nodes (except the first which is often unbranched). Additional axillary branches or buds are also present at the nodes of the primary branches. A solitary head terminates each branch.

The heads are enclosed and somewhat concealed by subtending pairs of leaves. The two phyllaries follow the decussate pattern of the leaves (see fig. 6 and 11) and resemble immature leaves. In immature heads the subtending leaves are differentiated from the phyllaries mainly by the ciliate margins of the former and by their position. The two phyllaries partially surround the head and each subtends a pale and a marginal floret which is more advanced in development than other florets of the head.

The number of corolla lobes varies from 3 to 4, which is also true for the stamens. While the number of corolla lobes and stamens is often the same, there are sometimes florets with 4-lobed corollas and 3 stamens. Florets with 3-lobed corollas and 4 stamens have not been found. In one floret with two normal stamens a third stamen was found with the filament of twice the normal width and two fused anthers. Such a condition may support the contention that the 3- and 4-merous florets are the result of a reduction process which is still in progress.

Our findings confirm Blake's suggestion that the genus is related to *Jaegeria*. Among species of this genus it appears to be closest to *J. hirta* (Lag.) Less. The habit of *Cuchumatanea* is very similar to that of a collection of *J.*

Table 1. Comparison of *Cuchumatanea* with related genera.

	<i>Cuchumatanea</i> (<i>C. steyermarkii</i> , Beaman 3962)	<i>Jaegeria</i> (<i>J. hirta</i> , Beaman 4532)	<i>Siegesbeckia</i> (<i>S. repens</i> , Beaman 3699)	<i>Selloa</i> (<i>S. plantaginea</i> , Beaman 4240)
Heads	Discoid	Radiate	Radiate	Radiate
Phyllaries	2	5	5 outer and 2 series of inner	Very broad, imbricated in about 4 series
Pales	Not keeled	Keeled	Not keeled	Not keeled, narrowly linear
Number of disk florets	5-10	5-9	Ca. 40	Ca. 85
Number of disk corolla lobes	3-4	4-5	5	5
Style	Constricted below the branches	Not constricted	Not constricted	Not constricted
Style branches	Oblong-elliptical, acute, often unequal, papillose to the base	Lanceolate, acute, papillose to the base	Linear, acute, papillose to the base	Linear with triangular, tufted tips
Stamens	3-4, anthers sagittate, with broadly ovate to suborbicular appendages	5, anthers sagittate, with orbicular appendages	5, anthers slightly sagittate, green, with ovate appendages	5, anthers slightly sagittate, with broadly ovate appendages
Achenes	Brownish-black, striate, ellipsoid-oblong, glabrous	Brownish-black, striate, ellipsoid-oblong, glabrous	Brownish-black, striate, ellipsoid-oblong, glabrous	Brownish, striate, 5-angled, ellipsoid-oblong, glabrous
Pappus	Absent	Absent	Absent	3-5 deciduous awns

hirta (Beaman 4532) from La Cima, Federal District, Mexico. This specimen also has sagittate anthers with orbicular appendages which correspond closely to those of *Cuchumatanea*, although the latter has shorter thecae with thicker-walled cells along the margins. In another specimen of *J. hirta* (Bourgeau 1553 from the Valley of Cordoba, Mexico) the anthers seem to differ from those of *Cuchumatanea* mainly in not having thick-walled marginal cells. The genera are also similar in achenial structure, both having ellipsoid-oblong, slightly compressed, striate, glabrous achenes without pappus²

Although the features noted above indicate a close relationship of *Cuchumatanea* with *Jaegeria*, they differ by characters of a magnitude equal to those by which other Verbesinoid and Galinsoginoid Compositae are distinguished. The most important characters which separate the genera are as follows: (1) The heads of *Cuchumatanea* are discoid. Only *J. gracilis* Hook. f. from the Galapagos Islands is without ray florets (the type of *J. discoidea* Klatt, as noted by Robinson (1900), is radiate). (2) *Cuchumatanea* has only two phyllaries which do not surround the marginal florets but partially enclose the head. *Jaegeria* has 5 or more phyllaries each of which encloses an ovary or achene of a ray floret with slightly overlapping marginal membranes. (3) The tubular corollas of *Cuchumatanea* have 3-4 lobes rather than 5 as in *Jaegeria*, and the number of stamens in the former is also reduced. (4) The pales are unkeeled in *Cuchumatanea* and keeled in *Jaegeria*. (5) The chromosome number in *Cuchumatanea* is $n = 8$, while counts reported for four species of *Jaegeria* have all been on the base of $x = 9$ (Turner et al., 1962; Beaman and Turner, 1962; Turner

²After submitting the manuscript for publication we sent a copy of it and some of the material of *Cuchumatanea* to Dr. A. M. Torres who is currently monographing the genus *Jaegeria*. He notes that the specimen of *Jaegeria hirta* (Beaman 4532) which we have used for comparison is at the extreme end of variation (a reduced form) in this species and that more typical specimens appear less similar to *Cuchumatanea*. He considers *J. axillaris* Blake, known only from the type collection from Colombia, to be closer to *Cuchumatanea*.

and King, 1964). A further comparison of similarities and differences of *Cuchumatanea* and *Jaegeria*, in addition to the characters of two other related genera, is given in Table 1. We have not found any features to support Blake's tentative suggestion that *Cuchumatanea* might be related to *Schkuhria* (Helenieae).

Because of its alliance with *Jaegeria* and other genera placed by Hoffmann (1894) in the subtribe Verbesininae, we tentatively assign *Cuchumatanea* to this subtribe next to *Jaegeria*. A more satisfactory classification may ultimately bring certain genera of the Galinsoginae into closer association with this group of the Verbesininae.

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LITERATURE CITED

- BEAMAN, J. H., and B. L. TURNER. 1962. Chromosome numbers in Mexican and Guatemalan Compositae. *Rhodora* 64: 271-276.
- HOFFMANN, O. 1894. Compositae in Engler & Prantl, *Natürl. Pflanzenfam.* 4⁵: 87-391.
- ROBINSON, B. L. 1900. Synopses of the genera *Jaegeria* and *Russelia*. *Proc. Amer. Acad.* 35: 315-321.
- TURNER, B. L., A. M. POWELL, and R. M. KING. 1962. Chromosome numbers in the Compositae. VI. Additional Mexican and Guatemalan species. *Rhodora* 64: 251-271.
- TURNER, B. L., and R. M. KING. 1964. Chromosome numbers in the Compositae. VIII. Mexican and Central American species. *Southwest. Nat.* 9: 27-39.

SEED GERMINATION OF *SHORTIA GALACIFOLIA* T. & G. UNDER CONTROLLED CONDITIONS¹

MARY H. RHOADES²

Until 1936 it was believed that *Shortia galacifolia* could not reproduce by seed because the scapes decayed and fell over before the seeds were mature (Kelsey, 1902). Observations by Ross (1936) disclosed that *Shortia* seeds do reach maturity and germinate, but in an unusual manner. Germination occurs in the capsule, the seeds being held against the placenta by the firm, partially opened capsule walls. In this position the seeds do not readily fall out when ripe, and are kept fairly moist because the capsule and cup-like calyx retain water. Seedlings reach the ground when the scape decays and falls. There they have little chance of survival because of predation by insects and because of the dense mass which *Shortia* plants form by vegetative reproduction. Attempts by Ross to germinate seeds on soil in the laboratory were unsuccessful, and he concluded that there was little possibility for the spread of *Shortia* plants by seed.

Ross's work suggests that seedlings of *Shortia* would be rare in nature, and that most of them would be near mature *Shortia* plants. On the contrary, several people have reported finding abundant seedlings in the field, both underneath (Crandall, 1956) and several feet from patches of mature plants (Crandall, 1956; Vivian, 1965). However, it was not determined whether these seedlings were from seeds which germinated in the capsule or on the ground. Since it is more likely that seeds are transported rather than seedlings, it appeared worthwhile to investigate the possibility of seed germination outside the capsule.

Capsules of *Shortia galacifolia* were collected on May 15, 1964, at an elevation of 1440 feet on the northwest side of

¹Part of a thesis submitted in partial fulfillment of the requirements for the M.A. degree at Duke University, Durham, North Carolina

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Crossroads Mountain in Transylvania County, N.C. The capsules were open and most of them contained many seeds, but no seedlings were found in them. Immediately when picked they were wrapped in paper towels and put in plastic bags to prevent drying.

A previous experiment showed that freezing the seeds did not impair germination, so the capsules were kept frozen until the seeds could be removed and counted. When the seeds were removed from the capsules, those with any visible defect, such as mold, discoloration, or extreme flatness, were discarded. The sound seeds were then put into envelopes of 50 seeds each and refrozen until all seeds were sorted. To prevent the seeds from drying out, only about six capsules were taken from the refrigerator at a time for removal of the seeds.

Eight environmental factors were tested for their effects on germination. Temperature, moisture, and light were combined into one experiment, so there were six experiments in all. For all but the first experiment, germination was tested in an air-conditioned room with a temperature range of 20° to 24°C and a light intensity of 30 ft-c. Germination was tested in all treatments, except those involving soil, by sprinkling the seeds on moist Whatman No. 1 filter paper in a clean 9 cm petri dish. The paper was moistened once a day with distilled water from a medicine dropper.

Each treatment included six replications of 50 seeds each. The seeds were assigned to a particular treatment by numbering the envelopes of seeds and then using a table of random numbers to select the envelopes for a prearranged order of treatments. The number of seeds germinated was recorded every 4 days up to 32 days, and then once again after 50 days. The first appearance of the radical was the criterion for germination.

To determine the effect of the interaction of temperature, moisture and light, germination was tested at 10°, 20°, and 30°C, in the light and the dark, and at three moisture levels. The moisture levels were "abundant," in which the filter paper was saturated with water; "sufficient," in which it

was thoroughly moistened but not saturated; and "deficient," in which it was never thoroughly moistened. Both incandescent and fluorescent lamps provided illumination. The combinations of three temperatures, two light conditions, and three moisture levels made 18 treatments.

Two other treatments tested the effect of a changing temperature regime on germination. In one treatment seeds were placed alternately between 10°C and 20°C every 48 hours. In the other treatment seeds were moved progressively from 10°C, to 20°C, to 30°C. After 5 days at each of these temperatures, the seeds were put at 22°C for the remaining time. For both of the changing temperature treatments the seeds were kept in the light and given "sufficient" moisture.

Since *Shortia* seeds germinate within the capsule, it was decided to test the effect of capsule parts on germination. For example, the calyx from about 10 capsules was cut up and the pieces were sprinkled on the filter paper along with the seeds. The placenta, calyx, and ovary wall were tested for their effects in this way. To obviate the effect of moisture retention by capsule parts, a control treatment was set up in which pieces of filter paper were sprinkled in the dishes. The cumulative effect of the capsule parts was tested by two treatments: putting seeds into empty, intact capsules and putting pieces of all capsule parts with the seeds.

Three other experiments were designed to test the effect on germination of substrate type, acid, and soaking. Steam sterilized sand, sphagnum, and a mixture of two parts sandy loam, one part sand, and one part sphagnum were the substrates tested. Petri dishes were half filled with the substrate and the seeds were sown on the surface, which was kept moist. The acid solutions tried were glacial acetic acid of pH 3.5 and two leachates of pH 4.5, one of moss and the other of leaf litter collected at the site where the seeds were obtained. Soaking periods used were 1, 3, 6, and 9 days in distilled water. Seeds kept at 22°C in the light and with "sufficient" moisture were used as the control for all tests.

In the final experiment six lots of 200 seeds each were put in petri dishes and allowed to air dry for 1 to 6 days before they were transferred to moist filter paper. Duplicate sets of 100 seeds each were also air dried, then weighed and oven dried at 105°C to a constant weight. In this way moisture content of the seeds, as percentage oven-dry weight, was determined for each of the air drying periods.

Although eight tests were designed for statistical treatment of the results, for some tests the great variation in number of seeds germinated among replications or the low total number of seeds germinated made a meaningful statistical analysis impossible. Even the mean and the standard deviation cannot be given for some treatments because they indicate the possibility of a negative number of germinations, which is meaningless.

Table 1 gives the results for the effect of temperature, moisture, and light on germination. Many more seeds germinated at 20°C than at 30° or 10°C, and more germinated in the light than in the dark. No germination occurred at the "deficient" moisture level in any temperature regime. At 20°C more seeds germinated in the "abundant" moisture condition than in the "sufficient." The difference is significant at the 2.5% level using a Student's t-test (Abundant, mean number of germinations/50 seeds = 4.33 ± 1.51 ; Sufficient, mean = 2.17 ± 1.33).

The effect of the changing temperature treatments on germination is also shown in Table 1. Almost identical results were obtained for the two treatments. A constant temperature of 20°C was as good for germination and perhaps better than, the two changing temperature regimes.

The presence of the placenta, the calyx, the ovary wall, or all parts improved germination about fivefold over that of the control. An analysis of variance using the 2.5% significance level showed that there was no difference among the treatments involving capsule parts. Adding filter paper instead of capsule parts did not improve germination.

Sand and sphagnum were superior to the sandy loam mixture or filter paper as substrates for seed germination.

Table 1. Effect of Temperature, Moisture, and Light
On Seed Germination of *Shortia galacifolia*

Temperature and Moisture	Number of Seeds Germinated After 50 Days (300 seeds/treatment)	
	Light	Dark
10° C		
Abundant	0	0
Sufficient	0	1
Deficient	0	0
20° C		
Abundant	26	2
Sufficient	13	0
Deficient	0	0
30° C		
Abundant	1	0
Sufficient	0	0
Deficient	0	0
Changing temperature		
Alternating 10°, 20°	4	
Increasing 10° to 20° to 30° to 22°	3	
Constant 20°	13	

Using water with leaf litter in it instead of plain distilled water may have improved germination slightly, but using water with moss or glacial acetic acid added did not. Better germination was obtained for all soaking treatments than for the control, and the period of soaking had no effect.

The average moisture content of *Shortia* seeds before they were air dried was 12% oven-dry weight. No loss of germinative capacity occurred for seeds air-dried for up to 6 days. However, no loss of moisture occurred, because the vapor pressure deficit of the air remained low over the whole period. A separate set of 100 seeds was made up to be left until a significant amount of moisture was lost. The seeds were allowed to air-dry for about 3 days. Since no moisture loss had occurred after this time, the seeds were put in an oven at 30°C for 12 hours. Their weight was reduced 4% during this treatment, which was three times the weight lost by any of the air-dried lots of seeds. After removal from the oven, the seeds were left in the air for 20 days.

They had regained their original weight when they were put on moist filter paper to test germination. None of the seeds germinated.

For 21 treatments the number of seeds germinated was recorded every 4 days. For most of the treatments the first germination occurred between 13 and 16 days from the start. Soaking caused germination to begin 4 to 8 days earlier.

The distribution of germination over the 32 day period followed no particular pattern. A final count for all treatments was made after 50 days, and a few germinations were recorded at this time. Most germinations, however, had occurred before 32 days.

Seeds of *Shortia galacifolia* germinated in the laboratory under a wide variety of conditions, indicating that the seeds do not have to be in the capsule to germinate. The factors which appear to be most significant in influencing germination of *Shortia* seeds are temperature, moisture, light, and presence of capsule parts.

The optimum temperature for germination is probably around 20°C, because substantially more germination occurred at this temperature than at either 10°C or 30°C.

An abundant moisture supply is necessary for good germination. No seeds germinate when moisture is always deficient, but some may germinate when moisture is alternately available and unavailable. Although the evidence is not conclusive, it also appears that *Shortia* seeds lose their germinative capacity if their moisture content falls below a certain critical level, even if they later regain moisture. Soaking seems to improve germination slightly, and even 9 days of soaking does not impair germination.

Light appears to be beneficial for germination, since many more seeds germinated with 900 ft-c illumination than in the dark or with 30 ft-c.

Although any capsule part improved germination when present with the seeds, combining parts did not produce a cumulative effect. Using leachate from leaf litter to water the seeds did not improve germination as much as the

presence of capsule parts, indicating that there is some organic substance peculiar to *Shortia* which aids germination.

From the results of the various tests it might be predicted that the best germination of *Shortia* seeds would be obtained by soaking the seeds at least 1 day, using sand as a substrate with capsule parts scattered over the sand, providing an illumination of about 900 ft-c, and supplying abundant moisture. Combining the two treatments which gave the best germination, "addition of placenta" and "20°C-light-abundant moisture," was tried, but no increase in percentage of germination resulted.

Although germination of *Shortia* seeds in nature outside the capsule has never been observed, the results of the laboratory experiment indicate that it undoubtedly occurs. Factors which were found to be important for good germination in the laboratory are present in the natural habitat. Micro-environmental measurements made in several different stands of *Shortia* show that the air temperature during the growing season ranges from 13°C to 32°C, that the relative humidity never falls below 50%, and that the light intensity ranges from 20 to 1000 ft-c (Vivian, 1965). Decaying capsule parts and leaf litter are present on a sandy soil.

In 1936, Ross thought the answer to the extreme localization of *Shortia* was the fact, that the seeds are held tightly in the open capsule and must germinate there, thus limiting the spread by seed. Although Ross noted that some seeds fall from the capsules, he did not mention how many. The author has observed that 50% or more of the seeds may be lost within a month after the capsules open. Rain is probably the primary agent in releasing the seeds, which could easily be carried far from the mature plants by rivulets or streams. It does not seem that lack of seed dispersal can be used to explain why *Shortia* fails to colonize new, apparently suitable habitats. Low seedling survival may be much more important in limiting the spread of *Shortia* by seed. Observations suggest that the seedlings grow very slowly in nature and are quite subject to winter kill (Vivian, 1965). Seeds germinated in the laboratory produced seedlings about

2 cm high after 8 months of growth. The amount of competition that seedlings can tolerate is probably small. It seems that the problem of the restricted and discontinuous distribution of *Shortia galacifolia* has not been solved, but that requirements of mature plants, competition, and seedling survival, perhaps along with a low percentage of germination, are more significant factors than lack of seed dispersal.

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LITERATURE CITED

- CRANDALL, DOROTHY L. 1956. *Shortia galacifolia* in Gray's Manual range. *Rhodora* 58: 38-40.
- KELSEY, H. P. 1902. *Shortia*, p. 1664. In L. H. Bailey, *Cyclopedia of American Horticulture*. Macmillan Company, New York. 4 York Bot. Gard. 37: 208-211.
- VIVIAN, V. E. 1965. Department of Biology, Glassboro State College, vols.
- ROSS, M. N. 1936. Seed reproduction of *Shortia galacifolia*. J. New Glassboro, New Jersey. Personal communication.

THE APPLICATION OF THE LINNAEAN NAMES OF SOME NEW WORLD SPECIES OF EUPHORBIA SUBGENUS CHAMAESYCE

DEREK BURCH

In 1960 Wheeler resurrected a subject which most workers in the *Euphorbiaceae* must have thought long since settled. His proposal, in 1939, to change an established and well understood usage of the name *Euphorbia maculata* L. stirred up a controversy which had died down in print by 1948 (Svenson 1945; Fosberg 1946, 1947; Croizat 1947, 1948), and which Fosberg's rejustification of his earlier stand failed to revive in 1953. In 1962 Croizat answered Wheeler's case with what should have been the final word on the subject, but in the course of a revision of the genus *Chamaesyce* in the Caribbean it has been brought home to me that confusion still exists in American herbaria, and that some collectors are following Wheeler's suggestion even though the case for the change was never proved.

If this were the only Linnaean name whose application to a New World species of *Euphorbia sensu lato* had been questioned the matter would best be allowed to lie, but there are other situations to clarify and, since some of them depend on the use of *E. maculata*, I have reluctantly decided to drag the old bones of the argument out once more.

The other areas which must be discussed are the names for a group of erect, large-leaved plants including *E. hypericifolia* (the name which Wheeler refers to as a "pandora's box" — presumably with some knowledge since he was the last to force its lid closed); the confusion between the Caribbean *E. prostrata* and *E. chamaesyce* of the Old World, and finally a note on the application of the name *E. thymifolia* L. In the interests of brevity, only the relevant parts of earlier papers will be discussed.

Most of the confusion in applying the names proposed by Linnaeus stems from a difference in interpretation of the relative importance of the parts of the material on which

his description was based. Both Svenson (1945) and Stearn (1957) have published very lucid accounts of his descriptive method, pointing out the importance of the phrase-name, not only as a partial characterization of the plant but also as a key to the genus when taken in conjunction with the polynomials of the other species. These phrases were revised to maintain this differentiating function as new material or information was received, and the superseded phrases were put into synonymy.

A mistake commonly made in deciding the application of a Linnaean name is to confuse the need to establish the concept of species which was in the author's mind with the present-day wish to have a single specimen as a representation of the name given to the species. Linnaeus did not work with "type specimens", but based his species on an aggregate of earlier descriptions, illustrations, and actual material. It must be left to a worker familiar with the group, and having a clear understanding of the Linnaean method, to decide just what elements were included by Linnaeus in composing his polynomial phrase-name. Only when this has been done should the specimens now in the herbarium, which may or may not have been present when the *differentiae* were drawn up, be considered in the light of the International Code for designation as types of the names.

1. The application of *Euphorbia maculata* L.

The species to which Linnaeus gave the trivial name "maculata" is number 21 in *Species Plantarum* edition 1. The full entry is made up of the usual polynomial phrase-name and references to earlier works (in this case a description and illustration by Plukenet), an indication of habitat, and also a supplementary description including characters such as color which Dandy suggests to mean that it was taken from fresh material (personal comm. 1964). The author's concept, then, we know to be based on a plant which Plukenet described and illustrated, with the phrase-name rewritten to be comparable with others in the genus, and probably to include information taken from a specimen.

These are the facts in the case, and from this point we move into conjecture.

For many years the name *E. maculata* has been applied to a prostrate plant, a specimen of which is in the Linnaean Herbarium on sheet number 630-11. The sheet is marked "21 maculata", which agrees with the entry in *Species Plantarum*. Most authors have taken the number to be one written on the sheet by Linnaeus, although Savage (1945), in his invaluable catalogue of the herbarium, ascribes it to Sir J. E. Smith. When I examined the specimens last summer I was unable to decide between these two viewpoints, but, in any case, there is general agreement that the epithet "maculata" on the sheet was added by Smith.

There is another sheet, 630-4, on which Linnaeus wrote "17 Euphorbia maculata". In *Species Plantarum* number 17 is the species to which the trivial-name "hypericifolia" was given, and the specimen on the sheet is of one of a group of superficially similar erect species to which Linnaeus applied this name. It is clear that the number and the name on this sheet are contradictory, and that Linnaeus was mistaken in writing one or the other. The choice of which is in error is the first matter for conjecture, but in reaching a decision it should be borne in mind that the number was part of a major work which was in progress or had recently been completed (for it is not certain when the annotation on the sheet was made), while the name was, literally, a trivial name — a new, "shorthand" way of referring to a species, the use of which may still have been unfamiliar to Linnaeus. Wheeler, however, chooses to regard the trivial name as correct, the number as wrong, and on this builds the whole case for his application of the name. In effect, he first selected his type specimen, and then showed that it is feasible that it might have fitted Linnaeus' concept of the species.

Let us instead examine the entry in *Species Plantarum*, keeping in mind the two entities which have been offered as candidates for the name. The polynomial specific name, which was designed to separate the species from all others

rather than as a description, contains no features which positively identify or disqualify either plant. Wheeler was correct in omitting this as a factor in his argument. Consider, however, the position of the species in the genus. Linnaeus was a methodical worker, and his purpose was to distinguish between the discrete groups that he considered species. What better way is there of doing this than by arranging similar things together, and then pointing out the features in which they differ? It is not suggested that Linnaeus followed this plan with complete consistency, but Croizat (1962) has shown in convincing detail that his genus *Euphorbia* is laid out in this fashion. The succulent species fall in the early part, followed by the shrubby types, while in the section *Dichotomae*, species 16-26, the arrangement is even more systematic. Species 16 through 19 are of erect or ascending habit with serrate leaves, species 20 through 24 are prostrate and have various leaf margins, and species 25 and 26 are erect with entire leaves. The placement of 21 *maculata* between 20 *thymifolia* and 22 *prostrata* is strong evidence that the traditional application of the name to the prostrate plant is the correct one to follow.

The descriptive phrase of Plukenet is noncommittal for our purpose of deciding between the two species, and I would agree with Wheeler that the illustration must also be rejected as a decisive factor. However, I feel that he is rash in seizing on features of the italicized description that follows the note on the habitat in *Species Plantarum* to support his choice of a type specimen on which to base the name. In his most recent article (1960) he persists in assuming that one of the two now in the Linnaean Herbarium must be treated as a type specimen in the modern sense. Even if these sheets were in Linnaeus' possession at the time of writing *Species Plantarum*, Wheeler's choice of one over the other because it agrees with parts of the description may be countered by reference to other characters which would support the opposite choice. The shape of the leaves, and the description "subpilosa", for example,

are each more appropriate to the specimen of the prostrate plant on sheet 630-11 than to the other.

Nothing in the original entry in *Species Plantarum*, then, gives grounds for changing the application of the name, and there is sufficient doubt about Linnaeus' view of the specimens now in the herbarium for them to form an unreliable basis for such a drastic step. On the other hand it has been shown that the layout of *Species Plantarum* gives a positive reason for not making such a change, and the application to the prostrate species, affirmed by Jacquin's plate in 1772 and adopted by the vast majority of subsequent authors, should be maintained.

There is one further point that must be discussed before this matter may finally be laid to rest. Both Wheeler (1939, 1960) and Fosberg (1946, 1953), who correctly apply the name *E. hypericifolia* to an erect plant, take the statement "*Euphorbia maculata* similis *E. hypericifoliae*" by Linnaeus in the *Mantissa Altera* (1771) to be selection of the erect element from the two which they feel he had earlier combined under the name *E. maculata*. Croizat's dismissal of this as an irrelevancy (1947, 1948) was not satisfactory, but it was not until I had the opportunity to examine some of the books in the Linnaean Library that I found a reasonable explanation. One of the first books to use differential phrase-names in the manner of Linnaeus was Patrick Browne's *Civil and Natural History of Jamaica* (1756). Stearn (1957) reports that this delighted Linnaeus, who went through the book providing (for his own use in later publications) the *nomina trivialia* that Browne had thought it unnecessary to give. Browne's "Euphorbia 2. Minima reclinata, foliolis ovatis denticulatis . . ." gives as synonym the same "Tithymalus erectus acris . . .", Sloane Cat. 82, & H. t. 126" that Linnaeus included in his 17. *hypericifolia*. In recognition of this, "*E. hypericifolia*" has been written in the margin of this entry, probably by Linnaeus himself. Browne goes on to describe his plant ". . . it is a slender weakly creeper and seldom runs above three or four inches from the root; its branches are smooth and slender and the

leaves small and oval". Here, then, is the basis for the statement in the *Mantissa*. Linnaeus knew "maculata" to be a prostrate plant, and, on reading Browne's description of the plant based on the same element as his "hypericifolia" as a creeper, he simply drew attention to this similarity of habit.

2. The application of the name *Euphorbia hypericifolia* L., and the names for the group of morphologically similar species.

This group, with strong, spreading to erect stems and leaves which are usually toothed, includes at least four species in America. They are distinguishable on pubescence, size of capsule, and on stipule and seed-coat characters, and have somewhat distinct geographical distributions. The names under which they have been known may be summarized thus:

Entity A — northern plant with pubescence only in lines on stem; cyathia never glomerulate; capsules large; seed coat rippled . . . *Euphorbia nutans* Lag.; *E. preslii* Guss.; *E. hypericifolia* L. *sensu* Michaux, Torrey; *E. maculata* L. *sensu* Wheeler.

Entity B — plant of the southern United States to South America; rarely and sparingly pubescent; cyathia never glomerulate; capsules large; seed coat transversely ridged . . . *E. hyssopifolia* L.; *E. brasiliensis* Lam.; *Chamaesyce nirurioides* Millsp.; *C. jenningsii* Millsp.

Entity C — tropical or subtropical plant; rarely pubescent; cyathia glomerulate; capsules small; seed coat wrinkled . . . *E. hypericifolia* L.; *E. pilulifera* L.; *E. glomerifera* (Millsp.) L. C. Wheeler.

Entity D — tropical plant with all herbage close-pubescent; cyathia never glomerulate; capsules large; seed coat transversely ridged . . . *E. lasiocarpa* Klotzsch; *E. hypericifolia* L. *sensu* Wheeler.

The central problem here is the application of the name *E. hypericifolia* L., which has been widely used for both Entity A and Entity C, and which Wheeler proposed in 1939 for Entity D.

Entity B need not be involved in this discussion. It was described by Linnaeus in *Systema Naturae* edition 10 (1759) with the trivial name *hyssopifolia*, and this has been consistently applied by all authors except those who divided the taxon on the basis of leaf shape. Examination of a long series of this highly variable species has so far failed to

substantiate any such division, and the name *E. hysopifolia* L. should probably be applied throughout.

Wheeler's case for the application of the name *E. hypericifolia* to the pubescent West Indian species, Entity D, was made at a time when neither the Linnaean specimens nor Savage's catalogue was available for study. He examined photographs of the two sheets in the herbarium labelled "hypericifolia," and, having disposed of sheet 630-4 as the type of *E. maculata* L. in the fashion discussed above, he selected the second sheet, 630-3, as the type of the epithet *hypericifolia*. He correctly identified the specimen on this sheet as an example of Entity D, and proposed that the epithet be used for this species. The sheet, however, is marked "Br," indicating that it came from Patrick Browne, most of whose collections were not added to the herbarium until 1758 (Stearn, 1957), and, thus, could not have been considered by Linnaeus when he described his *E. hypericifolia*. Wheeler's proposal may be rejected on these grounds alone.

Entity D was first described by Klotzsch in 1843 under the specific name *E. lasiocarpa*. Grisebach, in his *Flora of the British West Indian Islands* (1864), reduced the taxon to varietal level under *E. hypericifolia* L., but there has been general agreement that it merits specific rank, and that the name used by Klotzsch should be maintained.

The question of the application of "hypericifolia" should also be approached by considering the entry in *Species Plantarum*. The polynomial phrase-name is taken without alteration from Wiman's *Euphorbia, ejusque Historia . . .*, a dissertation published under the supervision of Linnaeus in 1752. The entry here includes even more synonyms than are carried over into *Species Plantarum*, and also a description which makes it clear that a variety α , with almost solitary "flowers", and another β , with "flowers" collected into heads, were recognized and included in the concept of the species. Variety α is probably Entity A, which appears to be the plant described in most of the earlier works of Linnaeus given here as synonyms. Variety β is easily recog-

nisable as Entity C, and this was the plant described and illustrated by Sloane as "Tithymalus erectus acris . . ." and by Commelin as "Tithymalus Africanus, seu Peplis major Brasiliensis . . ." (fide Tab. 10, "Tithymalus Americanus, flosculis albis") to which reference is made in the synonymy. It is clear that Linnaeus held a broad concept of *E. hypericifolia* at the time of publication of Wiman's work and *Species Plantarum*, since the polynomial phrase-name of his earlier works was expanded in these to include features of Sloane's plant.

In a case such as this, where the elements included by Linnaeus are now considered to form more than one species, Stearn (1957) suggests that the choice as to which is to bear the name should take into account not only all parts of the type material, but also the author's intent, and, if possible, subsequent and current usage. We have seen that both Entity A and Entity C are represented in the synonymy, and that while Entity A was the first to be described, this is balanced by the later broadening of the description to include Entity C. There is little in the entry in *Species Plantarum* to guide the choice, and no indication of the author's intent. The usage of the names, however, is another matter. Sir J. E. Smith, who acquired the herbarium in 1783, favored Entity A (Torrey, 1843), and his example was followed by Michaux (1803), Torrey, and a few early American authors. With these exceptions there has been an overwhelming use of *E. hypericifolia* as the name for Entity C, including Crantz' *Institutiones Rei Herbariae* (1766), Miller's *Gardener's Dictionary* edition 8 (1768), Aublet's *Histoire des Plantes de la Guiane Française* (1775), Humboldt's *Nova Genera . . .* (1817), Hooker's *Exotic Flora* (1823), and Boissier in DC. *Prodromus* (1862). In fact, the usage is so firmly established that it would be very much against the interests of stability of nomenclature to consider making any change, and the name *E. hypericifolia* L. should continue to be applied to this subtropical, erect plant with small capsules usually borne in glomerules. Sloane's illustration, cited by Linnaeus in *Species Plantarum*, is an ap-

propriate lectotype for the name used in this fashion, and the specimen on which the illustration was based, if it still exists in the Sloane Herbarium in the British Museum, would constitute what Dandy has referred to as a "type-type" (Stearn, 1957).

The name for Entity A remains to be decided. The varietal status accorded it by Linnaeus was not questioned for a number of years, but in 1816 Lagasca described a taxon under the specific name *E. nutans*. Wheeler (1941) reports that he examined a specimen which probably represents the plant that Lagasca described, and concluded that the name was apparently based on unusually vestite plants of Entity A. On these grounds the name *E. nutans* Lag. will be adopted for this species, with the more commonly used but later name *E. preslii* Guss. passing into synonymy.

In summary, then, the names for this group of species are as follows:

- Entity A (Northern plant with large capsules) — *E. nutans* Lag.
- Entity B (Southern plant with large capsules) — *E. hyssopifolia* L.
- Entity C (Tropical plant with small capsules) — *E. hypericifolia* L.
- Entity D (Tropical plant which is densely pubescent) — *E. lasiocarpa* Klotzsch.

3. *Euphorbia prostrata* Ait. and *E. chamaesyce* L.

Wheeler suggested in 1941 that these two species are conspecific, basing his case on the fact that one of the two sheets labelled "chamaesyce" in the Linnean Herbarium (sheet 630-17) is actually a specimen of the plant which has been known as *E. prostrata* Ait. This sheet, however, is another of Brown's specimens, and was not in Linnaeus' possession until long after his description of *E. chamaesyce* in *Species Plantarum*. The other sheet (630-15) is a good example of the European species to which the name has usually been applied, and nothing in the original entry suggests that Linnaeus intended the limits of his species to be set broad enough to include the West Indian plant.

The two species are, in fact, quite distinct, and the annotation by Linnaeus on sheet 630-17 is a simple misidentification. Croizat (1945) has documented the consistent use of the two names for the distinct entities, and there seems

little room for argument against maintaining *E. chamaesyce* L. as the name for a Mediterranean plant not so far found in the New World, and *E. prostrata* Ait. as the name for a weed of the Old and New World tropics. Wheeler accepts this usage in a supplement to the second edition of Kearney & Peebles *Arizona Flora* published in 1962, but his correction has been overlooked by the authors of other floras which have appeared since that date.

4. Application of the name *E. thymifolia* L.

Wheeler (1941) drew attention to a suggestion by A. Gray that the specimens 630-10 "Euphorbia 20 thymifolia" and 630-11 in the Linnaean Herbarium are of the same entity. An examination of the sheets confirmed this, and that both are the prostrate *E. maculata* L. There is no specimen in the Herbarium of the plant which has traditionally been called *E. thymifolia* L., and the protologue in *Species Plantarum* is of little direct help in deciding the application of the name. The polynomial phrase-name and descriptions by Burmann and Plukenet indicate that the plant is prostrate and pubescent, with serrate leaves and "flowers" somewhat collected into groups, and the illustrations cited fit these descriptions but show no characters which are diagnostic.

Burmann, however, includes in his synonymy "*Chamaesyce*, Sloane Cat. 83". This was based on a specimen from St. Jago de la Vega, now in the Sloane Herbarium, which is cited by Fawcett and Rendle in *Flora of Jamaica* (1920) as an example of *E. thymifolia* L. in the sense in which the name is used by most authors. This gives a positive link between the name and a well-understood taxon, and since no other such link can be made, and since nothing in the protologue contradicts this usage, it seems reasonable to accept it even though Sloane's plant was probably not seen by Linnaeus (Stearn, 1957).

The plant to which this name has been applied is found in most tropical regions, and is distinguished from similar species by the shortness of the stalk of the female flower, which forces the cyathium to split down one side as the

capsule develops. Bernard, *Icones Bogorienses*, 4, t. 315. 1910, illustrates this character well. Grisebach, in his *Flora of the British West Indian Islands* (1864), treats the taxon as a variety *thymifolia* of *E. maculata* L., but Boissier in DC. *Prodromus* (1862), Drury in *Handbook of the Indian Flora* (1869), Urban in *Symb. Antill.* (1910), and most subsequent authors consider that it merits specific rank. This usage is now so widespread and so well understood that nomenclatural stability will be best served by maintaining it, unless some contrary intention on the part of Linnaeus can be shown.

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LITERATURE CITED

- CROIZAT, L. 1945. "Euphorbia chamaesyce" in the United States. *Bull. Torr. Bot. Club* 72: 312-318.
- . 1947. *Euphorbia maculata* L. *Bull. Torr. Bot. Club* 74: 153-155.
- . 1948. *Euphorbia maculata*: A rejoinder. *Bull. Torr. Bot. Club* 75: 188.
- . 1962. Typification of *Euphorbia maculata* L. A Restatement and a Conclusion. *Webbia* 17: 187-205.
- FOSBERG, F. R. 1946. Application of the name *Euphorbia maculata* L. *Rhodora* 48: 197-200.
- . 1947. *Euphorbia maculata* again. *Bull. Torr. Bot. Club* 74: 332-333.
- . 1953. Typification of *Euphorbia maculata* L. *Rhodora* 55: 241-243.
- JACQUIN, N. J. 1772. *Hortus Botanicus Vindobonensis* 2: 87, t. 186. Vienna.
- KLOTZSCH, J. F. 1843. *Nov. Act. Nat. Cur.* 19: (supp. 1): 414.
- LAGASCA, M. 1816. *Genera et Species Plantarum* . . . 17. Madrid.
- LINNAEUS, C. 1753. *Species Plantarum* ed. 1. Stockholm.
- . 1771. *Mantissa plantarum altera*. Stockholm.
- MICHAUX, F. A. 1803. *Flora boreali-americana*. Paris.
- SAVAGE, S. 1945. *A catalogue of the Linnaean Herbarium*. London.
- STEARNS, W. T. 1957. *An introduction to the Species Plantarum and cognate botanical works of Carl Linnaeus. (Introduction to Ray Society facsimile of Species Plantarum ed. 1).* London.

- SVENSON, H. K. 1945. On the descriptive method of Linnaeus. *Rhodora* **47**: 273-302, 363-388.
- TORREY, J. 1843. *Flora of the State of New York*. Albany.
- WHEELER, L. C. 1939. A miscellany of the New World Euphorbiaceae — II. *Contr. Gray Herb.* **127**: 48-78.
- . 1941. *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of southern Florida. *Rhodora* **43**: 97-154, 168-205, 223-286. (Reprinted as *Contr. Gray Herb.* **136**).
- . 1960. Typification of *Euphorbia maculata*. *Rhodora* **62**: 134-141.

IDENTITY OF WITCHWEED IN THE SOUTHEASTERN UNITED STATES

In 1956 witchweed was found to be parasitizing field plantings of corn (*Zea mays* L.) in North Carolina and South Carolina. Because potential loss from this infestation is severe, immediate steps were effectively taken to prevent the spread of the parasite. The original specimens were tentatively identified as *Striga asiatica* (L.) O. Kuntze. The botanical nomenclature of this genus has been subject to interpretation by the various botanists who have dealt with it and only recently has an effective review been written (Saldanha, C. J. 1963).

In late 1964, Dr. V. P. Rao, a visitor from India, questioned the identification of the witchweed in the United States. He kindly furnished a copy of the Saldanha paper and a suite of specimens identified by Saldanha with which the local *Striga* could be compared. No doubt remains that this plant is *Striga lutea* Lour., which includes one of the elements of *S. asiatica*, a name now abandoned as a source of confusion.

However, Rao writes (in a personal communication) ". . . . the species found in the United States has red flowers which I have never seen in the common witchweeds which we come across in this country [India]." While it is true that the bulk of the population in the United States has very bright chinese-red flowers, individuals with lemon yellow flowers occasionally appear. Rarely an individual plant is found in which the flowers are yellow with red marks or stripes. Perhaps the flower color is due to the original introduction of red-flowered plants from Kottayam, India, where a population is known, or from South Africa, where the bulk of the plants of this species are said to be red-flowered.

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BROMUS MOLLIS AND ALLIES IN NEW ENGLAND

FRANK C. SEYMOUR

A problem like that in many other species is presented by *Bromus mollis* L., in which confusion has arisen because of unrecognized species, varieties, or forms. Apparently this species has been interpreted as including all specimens with short peduncles and hairy lemmas. In its form with glabrous lemmas, it has often been confused with *B. racemosus* L., and the form of *B. commutatus* Schrader with hairy lemmas has often been mistaken for typical *B. mollis*.

To Mr. Peter S. Green of the Arnold Arboretum I am indebted for calling my attention to the presence, in New England, of more than one species commonly included in *Bromus mollis*, for lending me a key which set apart neglected or little recognized taxa, and for making very valuable suggestions regarding this article. To him I express my hearty thanks. I thank Dr. Richard A. Howard, Director of the Arnold Arboretum, and Dr. Reed C. Rollins, Director of the Gray Herbarium, and Mr. Richard J. Eaton, Curator of the Herbarium of the New England Botanical Club, for the privilege of referring to specimens deposited in their institutions. I appreciate very much the help of Dr. Robert C. Foster, of the Gray Herbarium, and Dr. Lily M. Perry and Mr. Green, of the Arnold Arboretum, in finding references for original descriptions. I thank Mrs. Lazella M. Schwarten for the facilities of the Harvard Herbarium Library, and Dr. C. E. Hubbard of the Royal Botanic Gardens, Kew, England, for the reference for *B. commutatus* Schrader var. *pubens* Wats. Appreciation is expressed also to Dr. Howard W. Pfeifer, of the University of Connecticut and Mr. Leopold A. Charette, until recently of Yale University, for citations of specimens in their respective institutions.

In 1833, Hardouin (Congr. Sci. France 1: 59. 1833) proposed a new name, *Bromus Thominii*, for a grass which had previously been described and named *B. arenarius*

Thomine-Desmases (Mem. Soc. Linn. Calvados 1: 40. 1824) because Labillardière had used the name *B. arenarius* for another species in 1804. However, many botanists have considered this species not sufficiently distinct from *B. mollis*; and in America, where it has been introduced, it has commonly been overlooked or ignored to the present time. In 1924, another segregate of *B. mollis* was recognized at specific rank, namely *B. lepidus* Holmberg (Botaniska Notiser 1924: 326.).

Plants differing from the typical by having, or lacking, pubescence on the lemmas occur in these species and have often been treated as varieties. Here, the example of Fernald and Holmberg is followed by reducing them to forms. When a taxon differs from the typical variant in only one character and does not seem to have a distinct geographic range, it seems more appropriate to recognize it as a form rather than a variety.

Much of the confusion in these species arises from the fact that all three of them and also *Bromus commutatus* Schrader and *B. secalinus* L. may have either glabrous or hairy lemmas. Consequently, pubescence on the lemmas, or lack of it, does not separate these species. In an effort to clarify this group and some others to which they are closely related, the following key is presented, dealing with all the New England species in the sections Bromium Dum. in the Manual of Grasses of the United States by A. S. Hitchcock, ed. 2 by Agnes Chase, 1951, and Zeobromus Griseb. in Gray's Manual, ed. 8, by M. L. Fernald, 1950.

- A. Branches of panicle short; peduncles all or mostly shorter than spikelets; panicle erect; margins of lemmas overlapping the lemma next to them.
 - B. Lower lemmas 8-11 mm long; lower glume (6-)7-9 mm long; upper glume (7-)8-9 mm long. 1. *B. mollis*.
 - C. Lemmas hairy. 1a. *B. mollis* f. *mollis*.
 - C. Lemmas glabrous. 1b. *B. mollis* f. *leiostachys*.
 - B. Lower lemmas 5.5-7.5 mm long; lower glume 4.5-6 mm long; upper glume 5.5-6.6 mm long.
 - D. Lower lemmas 6.5-7.5 mm long; lower glume 4.5-6 mm

- long; upper glume 6-6.6 mm long; grain shorter than palea.
 2. *B. Thominii*.
 E. Lemmas glabrous, except minutely scabrous margins.
 2a. *B. Thominii* f. *Thomènnii*
 E. Lemmas hairy. 2b. *B. Thominii* f. *hirsutus*.
 D. Lower lemmas 5.5-6.5 mm long; lower glume 4.5-5 mm
 long; upper glume 5.5-6 mm long; grain longer than
 palea. 3. *B. lepidus*.
 F. Lemmas glabrous. 3a. *B. lepidus* f. *lepidus*.
 F. Lemmas hairy. 3b. *B. lepidus* f. *lasiolepis*.
 A. Branches of panicle longer; peduncles all or mostly longer than
 spikelets; panicle erect or drooping; margins of lemmas not always
 overlapping the lemma next to them.
 G. Margins of lemmas inrolled at maturity, leaving axis visible;
 lemmas 6.5-9 mm long. 4. *B. secalinus*.
 H. Lower lemmas 7-9 mm long; sheaths glabrous.
 4a. *B. secalinus* var. *secalinus*.
 I. Lemmas awnless.
 4c. *B. secalinus* var. *secalinus* f. *submuticus*.
 I. Lemmas with awns 1-6 mm long.
 J. Lemmas glabrous.
 4b. *B. secalinus* var. *secalinus* f. *secalinus*.
 J. Lemmas hairy.
 4d. *B. secalinus* var. *secalinus* f. *hirtus*.
 H. Lower lemmas 6.5-7 mm long, glabrous; lower sheaths
 hairy. 4e. *B. secalinus* var. *hirsutus*.
 G. Margins of lemmas concealing axis, not inrolled; lower lemmas
 6.5-12 mm long.
 K. Lower lemmas 6.5-8(-9) mm long.
 L. Anthers 3-4.5 mm long; upper lemmas about as long
 as lower; panicle open, its branches spreading, lower
 branches more than two at a node, each bearing two
 or more spikelets; lower sheaths hairy, upper sheaths
 glabrous. 7. *B. arvensis*.
 L. Anthers 2-2.5 mm long; upper lemmas distinctly
 shorter than lower; panicle rather dense, its branches
 erect or ascending, lower branches 1-2 at a node, each
 bearing 1 (rarely 2) spikelets; sheaths all hairy.
 5. *B. racemosus*.
 K. Lower lemmas 9-12 mm long.
 M. Spikelets drooping, 0.8-1.3 cm wide, awnless or nearly
 so; anthers 0.8-1 mm long; branches of panicle usually
 bearing 1 spikelet; lower lemmas about as wide as
 long; palea much shorter than lemma, about 6 mm
 long. 8. *B. brizaeformis* Fischer & Meyer

- M. Spikelets erect or ascending, 4.5-6 mm wide; awns usually 4-10 mm long; anthers 1.5-2 mm long; branches of panicle usually bearing 2 or more spikelets; lower (and other) lemmas much longer than wide; palea about as long as lemma. 6. *B. commutatus*.
 N. Lemmas glabrous except minutely scabrous margins. 6a. *B. commutatus* f. *commutatus*.
 N. Lemmas hairy. 6b. *B. commutatus* f. *pubens*.

To assist further in identifying these species, a few representative specimens are cited. *Bromus mollis* is too familiar to require citations; likewise the typical forms of some other species. It will be evident from the list that in America *B. Thominii* f. *hirsutus* also is frequent whereas the other species and forms most closely related to them are less common.

1. *Bromus mollis* L. Sp. Pl. ed. 2. 112. 1763.

1a. *Bromus mollis* f. *mollis*.

1b. *Bromus mollis* f. *lelostachys* (Hartman) Fernald, *Rhodora* 35: 316. 1933.

In this article Fernald makes clear the reasons why this infraspecific epithet must be used instead of *lelostachys* of Persoon.

REPRESENTATIVE SPECIMENS. MASSACHUSETTS: Roxbury, 1878, *E. Faxon* (VT); Lancaster, 1 July 1943, *F. C. Seymour* 7240 (NEBC). CONNECTICUT: Fairfield, 12 June 1914, *E. H. Eames* 8753 (GH). NEW JERSEY: Camden, 3 June 1877, *Parker* (GH). DISTRICT OF COLUMBIA: Washington, 31 May 1905, *A. S. Hitchcock*, Am. Grasses 891 (GH), distributed as *B. racemosus* L., see *Rhodora* 35: 316. 1933. MICHIGAN: near Lansing, 22 June 1886, *L. H. Bailey, Jr.* (GH). IDAHO: New Plymouth, 21 May 1910, *J. F. Macbride* 94 (GH). OREGON: without precise locality, *Elihu Hall* 1871 (GH).

2. *Bromus Thominii* Hardouin, Congr. Sci. France 1: 59. 1833.

2a. *Bromus Thominii* f. *Thominii*.

REPRESENTATIVE SPECIMENS. MASSACHUSETTS: Stockbridge, 25 July 1914, *R. Hoffmann* (NEBC). RHODE ISLAND: Block Island, 12 Aug. 1919, *C. B. Graves* (NEBC). CONNECTICUT: Bridgeport, 24 June 1915, *E. H. Eames* 9022 (NEBC). BRITISH COLUMBIA: Vancouver Island, 20 June 1907, *C. O. Rosendahl* 1887 (GH).

2b. *Bromus Thominii* f. *hirsutus* (Holmberg) Hylander, Uppsala Univ. Arskr 1945 (7): 85. 1945.

REPRESENTATIVE SPECIMENS. MAINE: Seal Harbor, Mt. Desert Island, 9 July 1928, *G. L. Stebbins, Jr.* 327 (NEBC); N. Berwick, 4 July 1892,

J. C. Parlin (GH, NEBC). MASSACHUSETTS: Salem, 26 May 1890, *W. P. Conant* (NEBC); Cambridge, 10 June 1891, *M. L. Fernald* (NEBC); Lincoln, 16 June 1913, *M. L. Fernald* (NEBC); Boston, Parker's Hill, June 1877, *C. E. Faxon* (GH); Centerville, 17 June 1896, *E. F. Williams* (NEBC); Nonamesset, 29 May 1928, *J. M. Fogg, Jr.* 3394 (NEBC); Penikese, 3 July 1928, *J. M. Fogg, Jr.* 3412 (NEBC); Chilmark, 23 Aug. 1895, *Sydney Harris* (NEBC); Nantucket, 15 June 1909, Mrs. *N. F. Flynn* (VT). RHODE ISLAND: Block Island, 30 June 1938, *K. P. Jansson* (CONN). CONNECTICUT: New London, 1891, *C. B. Graves* (GH); 16 June 1932, *K. P. Jansson* (CONN); Hartford, 2 June 1901, *A. W. Driggs* (GH). NEW YORK, Long Island, Orient Point, 26 July 1940, *K. P. Jansson* (CONN). MICHIGAN: Meridan Twp. T4N, R1W sec. 7, Ingham Co., *G. W. Parmelee* 231 (VT). ILLINOIS: Peoria, July 1904, *F. E. McDonald* (GH). NEVADA: King's Canon, *C. F. Baker* 1104 (VT). CALIFORNIA: Mather, 30 May 1931, *D. D. Keck* 1126 (GH); Redding, Shasta Co., 4 July 1914, *L. E. Smith* (GH); Webb Ranch, San Mateo Co., 5 May 1960, *D. M. Porter* 678 (GH). WASHINGTON: Pullman, 8 July 1950, *L. C. Hulbert* 499 (CONN).

3. *Bromus lepidus* Holmberg, Bot. Not. 1924: 326. 1924.

3a. *Bromus lepidus* f. *lepidus*.

REPRESENTATIVE SPECIMENS. MASSACHUSETTS: Stockbridge, 21 June 1915, *R. Hoffmann* (NEBC). CONNECTICUT: Bridgeport, 24 June 1915, *E. H. Eames* (VT).

3b. *Bromus lepidus* f. *lasiolepis* Holmberg, Bot. Not. 1924: 326. 1924. Syn. f. *micromollis* (Krösche) Holmberg in Hartman, Handb. Skand. Fl. ed. Holmberg, 265. 1926.

REPRESENTATIVE SPECIMEN. MASSACHUSETTS: Jamaica Plain, 19 June 1963, *P. S. Green* 49/63 (NEBC).

4. *Bromus secalinus* L. Sp. Pl. 76. 1753.

4a. *Bromus secalinus* var. *secalinus*.

4b. *Bromus secalinus* var. *secalinus* f. *secalinus*

4c. *Bromus secalinus* var. *secalinus* f. *submuticus* (Reichenb.) Ascherson & Graebner, Syn. Mitteleurop. Fl. 2(1): 604. 1901.

REPRESENTATIVE SPECIMENS. MAINE: E. Auburn, 1 Sept. 1897, ex herb. *E. B. Chamberlain* (NEBC); N. Berwick, 26 June 1896, *J. C. Parlin* (NEBC). MASSACHUSETTS: Jamaica Plain, 6 Aug. 1925, *E. J. Palmer* 28164 (NEBC); New Bedford, s.d., *E. W. Hervey* (NEBC). CONNECTICUT: West Haven, 30 June 1903, *R. W. Woodward* (NEBC).

4d. *Bromus secalinus* var. *secalinus* f. *hirtus* (F. Schultz) Seymour, stat. nov. Basionym: *B. mutabilis* F. Schultz var. *hirtus* F. Schultz, Flora 32: 234. 1849. Synonym: *B. secalinus* L. var. *hirtus* (F. Schultz) Ascherson & Graebner, Syn. Mitteleurop. Fl. 2(1): 604. 1901.

REPRESENTATIVE SPECIMENS. MAINE: Bethel, 25 June 1938, *L. A. Wheeler* (NEBC). CONNECTICUT: Southington, 26 June 1903, *C. H. Bissell* (NEBC).

4e. *Bromus secalinus* var. *hirsutus* Kindberg, Bot. Not. 1887: 32. 1887.

REPRESENTATIVE SPECIMENS: VERMONT: Townshend, 23 June 1912, *L. A. Wheeler* (NEBC). MASSACHUSETTS: Revere, 1878, *H. A. Young* (NEBC); Needham, 30 July 1883, *T. O. Fuller* (NEBC); Milton, 15 July 1918, *N. T. Kidder* (NEBC); Hingham, 11 July 1926, *C. H. Knowlton* (NEBC). RHODE ISLAND: Edgewood, 26 June 1913, *T. Hope* (NEBC). CONNECTICUT: Waterbury, 14 July 1910, *A. E. Blewitt* 160 (NEBC).

5. *Bromus racemosus* L. Sp. Pl. ed 2. 114.

REPRESENTATIVE SPECIMENS: MAINE: Foxcroft, 25 June 1894, *M. L. Fernald* 565 (NEBC); Seal Harbor, 9 July 1928, *G. L. Stebbins, Jr.* 326 (NEBC); 29 June 1899, *E. L. Rand* (NEBC). MASSACHUSETTS: Charlestown, 19 Aug. 1879, *C. E. Perkins* (NEBC); Brookline, 14 June 1883, *C. W. Jenks* (NEBC); Nantucket, 21 June 1910, *E. P. Bicknell* 9773 (NEBC).

6. *Bromus commutatus* Schrader, Fl. Germ. 1: 353. 1806. Synonym: *B. pratensis* Erhart ex Hoffm. Deutschl. Fl. ed. 2. 2: 52. 1800, non Lamarck 1783.

6a. *Bromus commutatus* f. *commutatus*.

6b. *Bromus commutatus* f. **pubens** (Wats.) Seymour, stat. nov.
Basionym: *B. commutatus* Schrader var. *pubens* Wats., Phytologist 1: 1062. 1844.

REPRESENTATIVE SPECIMENS: MAINE: N. Berwick, 27 June 1897, *J. C. Parlin* 849 (NEBC). VERMONT: Ely, 27 June 1935, *A. A. Beetle* 37 (NEBC). MASSACHUSETTS: Milton, 8 June 1924, *N. T. Kidder* (NEBC). CONNECTICUT: North Haven, 30 June 1962, *R. J. Eaton* 2 June 1909 & 18 June 1910, *E. P. Bicknell* (NEBC).

7. *Bromus arvensis* L. Sp. Pl. 77. 1753.

REPRESENTATIVE SPECIMENS: MASSACHUSETTS: Arnold Arboretum, 8 June 1942, *E. J. Palmer* 46002 (NEBC); Grafton, 30 June 1951, *B. N. Gates* 27059 (NEBC); Worcester, 10 July 1946, *B. N. Gates* 20499 (NEBC). CONNECTICUT: North Haven, 30 June 1962, *R. J. Eaton* (NEBC); Bridgeport, 1 July 1912, *E. H. Eames* 8543 (NEBC); Bridgeport, 10 July 1912, *E. H. Eames* 8568 (NEBC).

8. *Bromus brizaeformis* Fischer & Meyer, Ind. Sem. Hort. Petrop. 3: 30. 1837.

REPRESENTATIVE SPECIMENS: VERMONT: Charlotte, 27 June 1880,

C. G. Pringle (VT). MASSACHUSETTS: South Boston, 28 May 1879 & 8 June 1879, *C. E. Perkins* (NEBC); Charlestown, 23 July 1881, Herb. *C. W. Swan* (YU); New Bedford, 15 July 1903, Herb. *E. W. Hervey* (NEBC). CONNECTICUT: East Haddam, 5 July 1903, *H. S. Clark* (NEBC); New Haven, 1884, *R. W. Woodward* (NEBC). WASHINGTON: *Pullman*, May 1898, A. D. E. Elmer 1330 (VT); Whitman Co., Karniak Mt., Willamette Mer. 20 July 1951, *L. C. Hulbert* 2326 (CONN). ONTARIO: comte d'Haldimand, 2 July 1936, *F. Marie-Victorin*, *F. Rolland-Germain*, *F. Dominique* 46200 (CONN).

PRINGLE HERBARIUM

UNIVERSITY OF VERMONT, BURLINGTON

CONTRIBUTION TO THE FUNGUS FLORA OF NORTHEASTERN NORTH AMERICA. IV¹

HOWARD E. BIGELOW AND MARGARET E. BARR²

The following continues a report of unusual or rare species of higher fungi that we have collected in New England during recent years. In the summer of 1963 our field work was done in the White Mountains of New Hampshire, and during the summer and fall of 1964 we collected in the Mt. Mansfield area of Vermont. Although both years were generally dry in New England, sufficient moisture did accumulate at these two areas to produce a number of interesting species.

The senior author is responsible for the information on agarics, while the junior author has provided the data on ascomycetes. The colors within quotation marks are from Ridgway, R., 1912. *Color Standards and Color Nomenclature*. Washington, D. C. The collections are deposited in the Herbarium of the University of Massachusetts, Amherst, unless otherwise noted.

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¹I. *Rhodora* 62: 186-198. 1960. II. *Rhodora* 64: 126-137. 1962. III. *Rhodora* 65: 289-309. 1963. Contribution from the Department of Botany, University of Massachusetts, Amherst.

²Mrs. Howard E. Bigelow.



Plate 1331 *Callistosporium luteoolivaceum* (Berk. & Curt.) Singer.
 × 1.

BASIDIOMYCETES

Callistosporium luteoolivaceum (Berk. & Curt.) Singer, *Lloydia* 9: 117. 1946. Plate 1331.

Agaricus luteoolivaceus Berk. & Curt. *Ann. Mag. Nat. Hist.* III, 4: 286. 1859.

Agaricus coloreus Peck, *Buffalo Soc. Nat. Sci. Bull.* 1: 46. 1873.

Agaricus rubescentifolius Peck, *N. Y. State Mus. Rep.* 39: 38. 1886.

Collybia luteoolivacea (Berk. & Curt.) Sacc. *Syll. Fung.* 5: 215. 1887.

Collybia coloreae (Peck) Sacc. *Syll. Fung.* 5: 230. 1887.

Collybia rubescentifolia Peck, *N. Y. State Mus. Rep.* 41: 83. 1888.

Tricholoma rubescentifolium (Peck) Sacc. *Syll. Fung.* 9: 15. 1891.

Collybia coloreae var. *rubescentifolia* (Peck) Peck, *N. Y. State Mus. Rep.* 49: 51. 1896.

Callistosporium psilocybe Murr. & Singer, *Mycologia* 36: 363. 1944.

Pileus 1-4 cm. broad, convex at first with an inrolled and slightly incurved margin, expanding to broadly convex, finally plane, margin slightly inrolled for some time, exceeding gills at times, sometimes sulcate but not pellucid-striate, surface glabrous when moist, matted

fibrillose or innately radiate-fibrillose when faded, dull yellow at first becoming cinnamon to rufous brown ("orange cinnamon", "Hays russet", "brick red", "Brussels brown", "cinnamon rufous"), hygroph-anous, fading to yellowish or buff (near "antimony yellow", "deep colonial buff", "light ochraceous salmon", "light ochraceous buff"), disc darkest; flesh thin, rather brittle, watery yellowish fading to pale yellowish or whitish, no odor and taste or taste rarely bitter.

Lamellae adnate or adnexed, finally emarginate then seceding, close, broad (up to 7 mm.), not forked or intervenose, arched at times, yellow ("empire yellow", "yellow ochre", "antimony yellow", "chamois") not fading, edges crenate or merely uneven, at times marginate with reddish brown in age.

Stipe 2.5-5 cm. long 1.5-5 mm. thick at apex, equal or the base enlarged (up to 7 mm.), and tapering upward, solid at first (interior concolorous with pileus flesh), becoming hollow, at times eccentric, often curved, surface innately fibrillose-striate, concolorous with lamellae, darkening to dingy "ochraceous buff", "cinnamon", or "dresden brown", base with white tomentum and sometimes a few white rhizoids.

Spores $4.5-7 \times 2.5-4 \mu$, elliptical, sometimes elliptic-oblong, smooth, not amyloid, often with vinaceous droplets or contents in KOH, white in mass; basidia $16-28 \times 4.5-7 \mu$, 2- or 4-spored, often with vinaceous droplets or granules in KOH; pileus tissue: fresh material yellowish in water mount, revived material pale vinaceous in KOH, pigment in cell contents and often punctate-encrusted, surface at times with protruding cystidioid end cells, cuticular hyphae cylindrical, $2.5-5.5 \mu$ in diameter, tramal hyphae cylindrical to slightly inflated, $2-8 \mu$ in diameter, clamp connections absent; gill trama subparallel, broad, hyphae cylindrical to slightly inflated, $2.5-7.5(-9) \mu$ in diameter.

Scattered to gregarious or occasionally cespitose. On conifer logs and stumps.

Material examined: *Bigelow* 10788, near Katahdin Stream Camp-ground, Baxter State Park, Maine, August 6, 1962; 7309, 7310, 7311, Amherst, Massachusetts, August 4, 1958; 7411, Amherst, August 9, 1958; 7515, Amherst, August 17, 1958; 7600, Mt. Toby, Sunderland, August 27 1958; 7739, Mt. Toby, September 15, 1958; 7802, Mt. Toby, September 20, 1958; 8264, Amherst, July 25, 1959; 8956, Wahconah Falls, Dalton, July 26, 1960; 9007, D.A.R. State Forest, Goshen, August 2, 1960; 9234, D.A.R. State Forest, September 1, 1960; 9624, Pittsfield State Forest, Pittsfield, July 26, 1961; 9683, New Salem, August 2, 1961; 11990, near Sawyer Rock, White Mts. Nat. Forest, New Hampshire, July 27, 1963; 12246, Oliverian Brook Trail, White Mts. Nat. Forest, August 13, 1963; *C. H. Peck*, North Greenbush, New York (type of *Agaricus rubescentifolius*, NYS), August; *C. H. Peck*, Croghan (type of *Agaricus coloreus pro parte*, NYS).

This agaric can be very confusing in the field as the

colors of the pileus and stipe vary markedly according to the age of the carpophore or its moisture content. In my field work the brown stage of the pileus seemed to be encountered much more frequently than the yellow stage.

I have not had the opportunity to study other species in this genus, but the carpophores of *C. luteoolivaceum* at least turn a rather bright vinaceous red when dilute KOH solution is applied to fresh material. In drying, specimens become a dark vinaceous color over all.

Clitocybe albimontana Bigelow, *nomen novum*

Omphalina oreades Singer, Pap. Mich. Acad. Sci., Arts & Letters 32: 123. 1946.

Pileus (2.5-)4-10 mm. broad, convex with an incurved margin at first, expanding to broadly convex, disc rarely slightly depressed, glabrous and striate moist, disc brown, striations dark brown ("bister"), paler in between striations (near "snuff brown"), hygrophanous, fading to sordid alutaceous, fibrillose and opaque faded, fibrils often erect near margin; flesh thin, pliant, concolorous with pileus moist or faded, no odor, taste mild.

Lamellae decurrent, usually evenly and forming a collar on the stipe apex, narrow to moderately broad (± 1 mm.), distant, rarely forked, not intervenose, arched, color a pale "buffy brown", edges even.

Stipe 6-9 mm. long, 0.5-1.5 mm. thick, equal or tapering downward from a slightly enlarged apex, pruinose at first becoming glabrous, solid, rather soft, darker brown than lamellae ("buffy brown", "Saccardo's umber").

Spores $7.5-10 \times 3-4 \mu$, shape variable: elliptical to obovate or subcylindrical in face view, sublacrymoid or lacrymoid in side view, sometimes slightly bent at either end, smooth, not amyloid; basidia $24-31 \times 5.5-7 \mu$, 4-spored, sterigmata up to 7μ long, basidioles somewhat irregular in shape at times; cystidia not differentiated; pileus tissue: cuticle brown in KOH, pigment finely but distinctly encrusted, hyphae cylindrical or inflated, $3-8.5 \mu$ in diameter, trama pale brown, hyphae smooth or encrusted, cylindrical or inflated, $3-11 \mu$ in diameter, clamp connections absent; gill trama interwoven, pale brown, hyphae smooth or encrusted, cylindrical or inflated, $1.5-7(-11) \mu$ in diameter.

Scattered or gregarious. On moss or sandy soil in alpine zone.

Material examined: *Bigelow 11918, 11919*, Lake-of-the-Clouds Trail from peak, Mt. Washington, New Hampshire, July 23, 1963; *12339, 12340*, trail to Alpine Garden from peak, Mt. Washington, August 19, 1963; *R. Singer*, Mt. Washington (type of *Omphalina oreades*, F).



Plate 1332 *Hygrophorus lilacinus* (Laest.) M. Lange. $\times 1$.

The preceding records are apparently the first of this species since Singer found it twenty years ago in the same locality. *C. albimontana* is easily overlooked because of its small size and a tendency to grow under overhanging moss where water or paths have cut down into the soil. A number of carpophores were found on both east and west sides of the mountain below the peak.

In transferring *Omphalina oreades* to *Clitocybe*, a new species epithet is necessary because of *Clitocybe oreades* Murrill.

Clitocybe asterospora (Lange) Moser apud Gams, *Kleine Kryptogamen Flora* II, p. 52. 1953.

Gregarious. On wet moss, in depression between rocks.

Material examined: *Bigelow 14223*, top of Mt. Mansfield, Vermont, September 24, 1964.

This agaric appears to be rare in North America. I know of fruitings only in Michigan and Ontario besides the specimens found on Mt. Mansfield.

Hygrophorus lilacinus (Laest.) M. Lange, *Meddelelser om Grønland* 148(2): 63. 1957. Plate 1332.

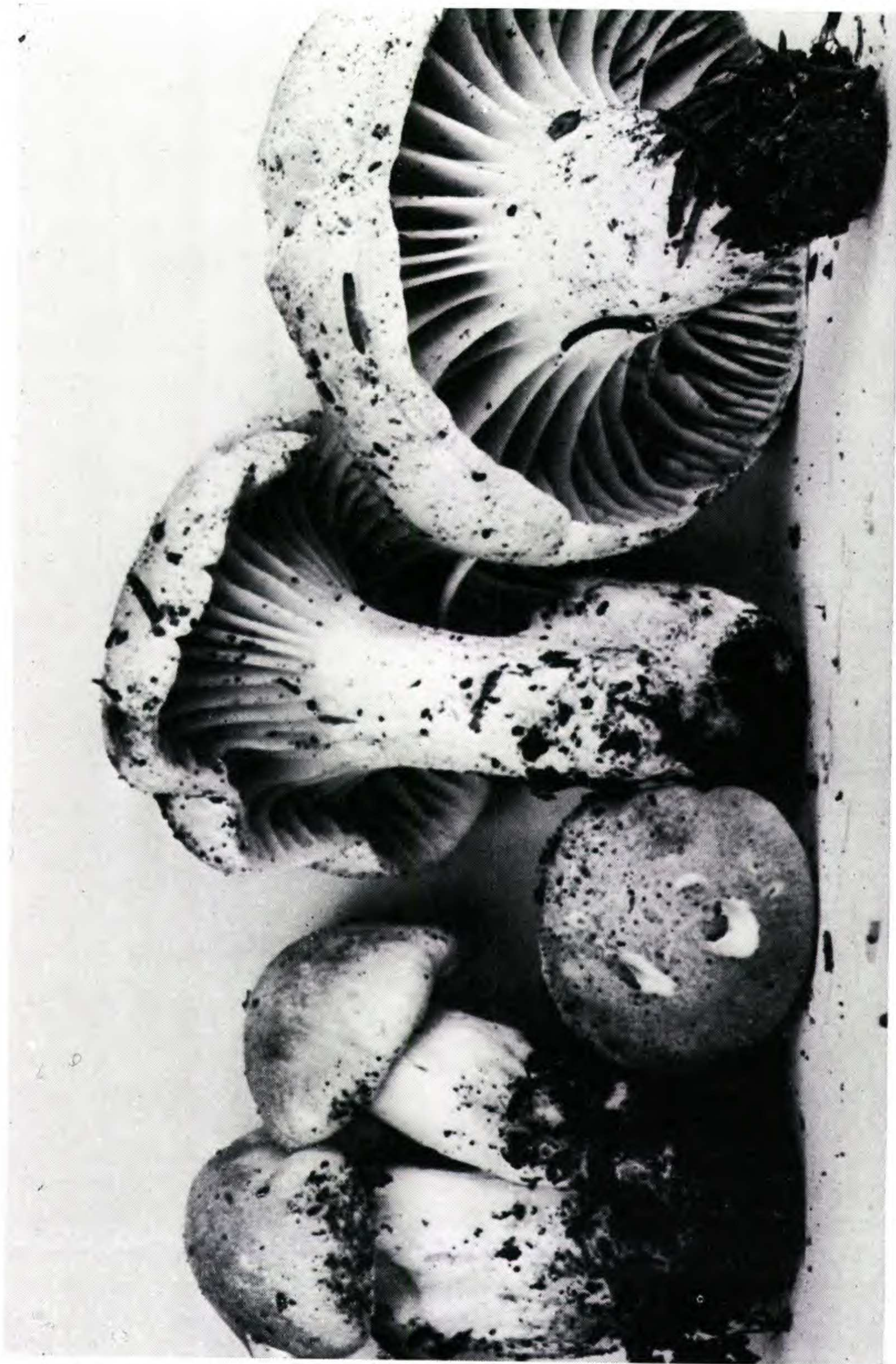


Plate 1333 *Hygrophorus monticola* Hesler & Smith. $\times 1$.

Agaricus (Omphalia) lilacinus Laestadius, Lapp. Torn. p. 45, n. 156. 1860.

Hygrophorus violeipes M. Lange, Meddelelser om Grønland 147(11): 18. 1955.

Material examined: *Bigelow 13656*, Mt. Mansfield, Vermont, August 29, 1964.

A small group of carpophores was found in a mossy depression near the "upper lip" on top of Mt. Mansfield. The bright luteous colors of cap and gills and the violet stipe make this species easy to recognize in the field. In microscopic characters as well as all field characters, my specimens agree exactly with Lange's (1955) description of *H. violeipes*. Apparently *Bigelow 13656* is the first record of *H. lilacinus* in North America.

In 1957, Lange placed *Omphalia luteolilacina* Favre in synonymy with *H. lilacinus*. While there is certainly a resemblance between the two species, I do not agree with Lange's treatment. As described by Favre (1955), *O. luteolilacina* lacks clamp connections, has elliptic-cylindric spores and a hispid stipe. These characters are unlike *H. lilacinus* and certainly sufficient to maintain *O. luteolilacina* as a separate taxon.

Hygrophorus monticola Hesler & Smith, North American Species of *Hygrophorus*, p. 359. 1963. Plate 1333.

Pileus 1.5-16 cm. broad, at first convex with an incurved and inrolled margin, not striate, slowly expanding to plane with a decurved margin, elevated in age, surface dry and unpolished, finely matted-fibrillose on disc under a lens, glabrous at the margin, cracked at times in age or dry weather, color dingy "cinnamon" to "vinaceous cinnamon" or "sandal brown", margin whitish at times, "russet vinaceous" over all when dry; flesh thick on disc, tapering abruptly to margin, whitish (near "cartridge buff"), firm, brittle, odor strong, sweet like that of cherries, taste mild.

Lamellae decurrent (evenly at times and forming a collar on the stipe apex), distant, thickened, broad (3-11 mm.), occasionally forked, sides venose at times, arched, color "cream buff" to "ochraceous buff", edges even.

Stipe 2-12 cm. long, apex 0.8-4.2 cm. thick, equal in smaller carpophores but tapering downward strongly in larger ones, solid (white

within), no veil, surface dry and unpolished, velvety to pubescent under a lens, appressed in age, whitish.

Spores 9-11.5(-13) $\times$ 6-7.5 μ , elliptical, smooth, not amyloid; basidia 46-68 $\times$ 5.5-8 μ , 4-spored; cystidia not differentiated; pileus tissue: cuticle pale yellowish in KOH, pigment dilute in the contents of some surface hyphae, cuticle an ixocutis, hyphae cylindrical, 2.5-4 μ in diameter, walls thin, tramal hyphae mostly cylindrical, 3-9(-14) μ in diameter, walls often slightly thickened, clamp connections present; gill trama: divergent in young carpophores but appearing more interwoven in large caps, hyphae cylindrical, 4-7.5 μ in diameter.

Gregarious to cespitose. In soil and needle beds under spruce.

Material examined: *Bigelow* 13917, 13984, 14124, 14204, 14278, 14323, 14350, 14373, Lamoille and Washington counties, **Vermont**, September and October.

In Hesler and Smith's (1963) monograph of *Hygrophorus*, *H. monticola* is described from specimens collected in Idaho and eastern Canada. The pilei measured 2-5 cm. broad, and the stipes 3-6 cm. $\times$ 3-25 mm. In view of these dimensions, the Vermont specimens are most impressive in size. The odor of cherries was very pronounced as well and could be detected without crushing the flesh, sometimes from several feet away. Of further note, and perhaps worthy of emphasis in diagnosis, was the tendency of the pileus to become more intense in color with drying.

Hygrophorus nitiosus Blytt, Norges Hymenomycetes. Videnskabs Selskabets Skrifter. Math. Naturv. Kl. 1904, No. 6. 1905.

Gregarious. On soil of dirt road in hardwoods.

Material examined: *Bigelow* 13132, Stowe, Lamoille Co., **Vermont**, July 28, 1964.

Hygrophorus tahquamenonensis Smith & Hesler, Sydowia 8: 331. 1954.

Gregarious to subcespitoso, on moss by stream, near hardwoods.

Material examined: *Bigelow* 13242, Bingham Falls, near Stowe, Lamoille Co., **Vermont**, August 3, 1964.

Mycena atkinsoniana A. H. Smith, North American Species of *Mycena*, p. 144. 1947.

On leaves and humus under beech.

Material examined: *Bigelow* 13936, Bingham Falls, near Stowe, Lamoille Co., **Vermont**, September 9, 1964; 14059, near Lake Mansfield, Lamoille Co., September 14, 1964.

Paxillus curtisii Berkeley, Ann. Mag. Nat. Hist. II, 12: 423. 1853.

On hemlock logs.

Material examined: *Bigelow 11906*, South Conway, Carroll Co., New Hampshire, July 22, 1963; *12093*, same locality, August 3, 1963; *12398*, *12399*, same locality, September 4, 1963.

Phaeocollybia kauffmanii (Smith) Singer, Rev. Mycol. 5: 11. 1940.

Naucoria kauffmanii Smith, Mycologia 29: 52. 1937.

Pileus 1.3-5.5 cm. broad, obtuse-conic or convex at first with margin slightly incurved and narrowly inrolled, not striate, expanding somewhat to broadly convex with margin remaining incurved and inrolled, sometimes lobed, surface glutinous or viscid, smooth, glabrous, color watery "cinnamon" to "sandal brown", fading to "cinnamon buff", at times with a few dark reddish flecks; flesh thick, firm, whitish, odor and taste farinaceous.

Lamellae emarginate (notch small and abrupt, superficially appearing "free"), close, narrow to medium broad (2-7 mm.), forked at times, white at first then "vinaceous buff" or "pale pinkish buff", edges slightly uneven.

Stipe 4-13 cm. long, apex 5-11 mm. thick, often subventricose (up to 16 mm. thick), attenuated and radicating (about half of stipe above soil), at times twisted, usually curved below, surface innately fibrillose, moist but not viscid, solid (cortex thick and brown in section, interior firm, whitish to "pale ochraceous buff"), color watery "cinnamon buff" above, rufous stained below, especially on lower portion embedded in soil.

Spores $7.5-9 \times 5.5-6 \mu$, ovate in face view, inequilateral in side view, with a minute apical pore but no conspicuous beak, rugulose-roughened, fulvous in KOH; basidia $23-31 \times 7.5-10 \mu$, 4-spored, protruding beyond the hymenium at maturity; cystidia: cheilocystidia abundant, pleurocystidia rare, both basidioid to clavate in shape, sometimes rather irregular and with broad lump near apex, rarely 2-celled, often with dilute brownish contents, smooth, thin-walled; pileus tissue: surface layer a distinct gelatinous pellicle in KOH, hyaline, hyphae $1.5-2.5 \mu$ in diameter, trama brown in KOH, pigment finely but distinctly encrusted on some hyphae in subpellicular zone, in smooth and thickened walls below, hyphae cylindrical to somewhat inflated, $4-13 \mu$ in diameter, clamp connections absent; gill trama parallel, brownish in KOH, pigment in thickened but smooth walls, hyphae cylindrical, $3-8 \mu$ in diameter.

Scattered or subcespitose. On soil of river bank near hemlock.

Material examined: *Bigelow 13570*, Bingham Falls, near Stowe, Vermont, August 20, 1964.

P. kauffmanii is well known in the Pacific northwest

although apparently not common. Hesler (1949) has reported its occurrence in Tennessee, but I have not found any other record from the east. My specimens from Vermont fit Smith's (1957a) description except in dimensions of the carpophore. Western specimens of *P. kauffmanii* are considerably larger in size.

Pleurotus elongatipes Peck, Jour. Myc. 14: 1. 1908.

Pileus 2.5-14 cm. broad, convex to broadly convex or nearly plane, margin narrowly inrolled and incurved for some time, slightly pubescent when young, sometimes with short sulcations, surface glabrous, mottled about the disc with small watery-appearing spots, white to pale avellaneous or pale buff ("cartridge buff", "light buff"); flesh usually rather thick on disc, firm, brittle, odor often spicy and fragrant when flesh crushed, taste not distinctive.

Lamellae at first adnexed or adnate, becoming sinuate or emarginate, seceding at times, moderately broad (5-11 mm.) near stipe but narrowed at margin of pileus, usually close but sometimes crowded, not forked or intervenose, white or whitish, edges uneven and brittle in age.

Stipe 3-10 cm. long, apex 4-20 mm. thick, base usually somewhat enlarged and tapering upward, sometimes ventricose, solid (interior white and soft), cavernous in age, often curved, eccentric at times, surface with a thin fibrillose coating, becoming innately fibrillose-striate, apex pruinose to pubescent at times, white or nearly so.

Spores $4-5.5 \times 4-4.5 \mu$, globose to subglobose, smooth, not amyloid, white to slightly cream tinged in deposit; basidia $16-24 \times 4-6 \mu$, 4-spored, carminophilous granules absent; cystidia not differentiated; pileus tissue: surface subgelatinous to gelatinous in KOH, cuticular hyphae cylindrical, $1.5-3 \mu$ in diameter, tramal hyphae cylindrical to slightly inflated, $2.5-13 \mu$ in diameter, clamp connections present, walls thin or slightly thickened and refractive; gill trama regular to subparallel, broad, hyphae mostly cylindrical, $(1.5-4-9(-11) \mu$ in diameter, wall thin or slightly thickened and refractive.

Solitary or cespitose. On hardwood logs and stumps, sometimes in wounds of living maple.

Material examined: *Bigelow* 8665, North Pond, Savoy Mt. State Forest, Florida, **Massachusetts**, September 22, 1959; 9362, Beartown State Forest, Monterey, September 27, 1960; 10809, Katahdin Stream Campground, Baxter State Park, **Maine**, August 6, 1962; 11146, near Norcross, Penobscot Co., August 18, 1962; 11259, Cedar Lake, Penobscot Co., August 24, 1962; *D. E. Fischer*, Detroit, **Michigan**, October 5, 1905 (type, NYS); *Bigelow* 12524, Oliverian Brook Trail, White Mts. Nat. Forest, **New Hampshire**, September 7, 1963; 13842, near Johnson, Lamoille Co., **Vermont**, September 2, 1964; 13937, Bingham

Falls, near Stowe, Lamoille Co., September 9, 1964; 14048, Stowe, September 13, 1964; 14110, Ranch Brook Trail, Mt. Mansfield State Forest, September 16, 1964; 14116, Monroe State Park, Washington Co., September 17, 1964.

Pleurotus elongatipes has proven to be quite common in New England. I have found it growing on birch and poplar debris as well as on dead or living maple. A description based upon specimens from Mt. Rainer, Washington, has been published by A. H. Smith (1957b).

This species is a *Pleurotus* in the traditional sense of the genus, but the globose spores exclude it from modern interpretations. According to Singer's (1962) classification, the closest affinities may be with *Hypsizygus*, but some emendation of this genus would be necessary to admit *P. elongatipes*.

ASCOMYCETES

Keissleriella caudata (Müller) Corbaz, Phytopath. Zeitschr. 28: 411. 1957. Figure 8.

Material examined: Barr 2896, on cultivated rose stems, Conway, Massachusetts, May 7, 1961.

K. caudata was described from *Triticum* stalks in Europe. The collection on rose stems agrees with the description of the species, although the ascospores are slightly longer, $15.5-17.5 \times 3.5-4.5 \mu$ rather than $10-13 \times 4-4.5 \mu$. This species differs from *K. cladophila* (Niessl) Corbaz by smaller, thinner-walled ascostromata, lack of a clypeus, and narrower ascospores. *Keissleriella* is included in the Pleosporaceae.

Lasiosphaeria chrysentera Carroll & Munk, Mycologia 56: 83. 1964.

Material examined: Barr 3338, Abol Field, near Baxter State Park, Maine, July 6, 1962.

The species, described from Costa Rica, is closely related to *L. ovina* (Pers. ex Fr.) Ces. & de Not. *L. chrysentera* differs in golden-yellow pigmentation of the hymenium, bright yellow globule at apex of ascus, and yellowish ascospores. One additional collection has been examined from

Idaho, A. W. Slipp, U.I.F.P. Herb. 3834, on decorticated *Alnus tenuifolia*, 1943. *Lasiosphaeria* is a member of the Sordariaceae.

***Leiosphaerella falcata* Barr, sp. nov., figures 1-4.**

Perithecia 180-300 μ diametro, 130-250 μ alta, immersa, gregaria, ostiola eccentrica vel lateralia, 60-120 μ diametro, 70-150 μ alta, periphysata; peridium 13-16.5 μ crassum, brunneum, hyphis brunneis vestita. Asci 55-100 $\times$ 11-14.5 μ , elliptica, unitunicata, ad apicem poro amyloideo, paraphysati. Ascosporae 46-86 $\times$ 3-5 μ , fusiformae vel falcatae, hyalinae, uniseptatae, fasciculatae in ascis.

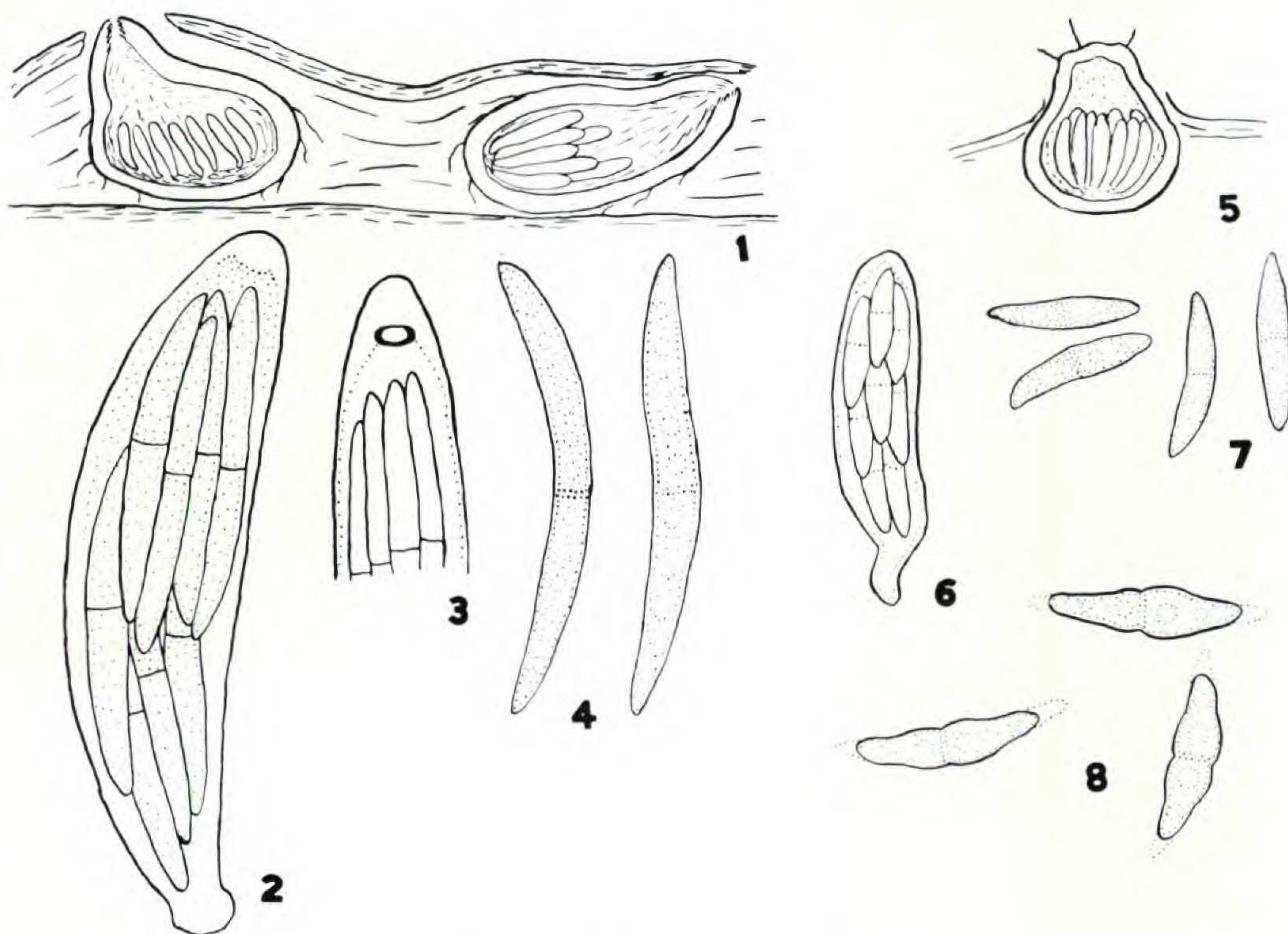
Specimen typicum in caulis *Aceris pensylvanicum* L., a M.E. Barr lectus, n. 3460, prope "Katahdin Stream Campground, Baxter State Park, Maine, July 23, 1962", in herbario Univ. Mass. depositum.

Perithecia 180-300 μ in diameter, 130-250 μ high, depressed globose, immersed beneath epidermis and raising it slightly, thickly scattered, ostiole eccentric to lateral, 60-120 μ in diameter, 70-150 μ high, piercing the covering layer of substrate, canal periphysate, perithecial wall 13-16.5 μ wide, of polygonal, brown, compressed layers of cells, inner layers hyaline, with brown hyphae surrounding perithecium and penetrating substrate tissues. Asci 55-100 $\times$ 11-14.5 μ , elliptical, apex rounded or truncate, narrowed abruptly below spores into rounded base, wall single, thickened above with refractive pore, amyloid in Melzer's, paraphyses deliquescent and forming an amorphous mass around asci. Ascospores 46-86 $\times$ 3-5 μ , greenish hyaline, fusiform to falcate, tapered to pointed ends, 1-septate in or near the middle, not constricted at the septum, wall thin, smooth, contents homogeneous or globular, in two overlapping fascicles in the ascus.

In small dead branches of *Acer pensylvanicum* and *A. spicatum*.

Material examined: Barr 3267, Norcross, Penobscot Co., Maine, June 30, 1962; 3460 (type), Katahdin Stream Campground, Baxter State Park, July 23, 1962; 3644, Norcross, August 18, 1962; 3995A, Stony Brook Trail, near Gorham, New Hampshire, July 26, 1963; 2098, Lake Munroe, Mt. Tremblant Park, Quebec, July 24, 1957; 4179, Underhill Camp Area, Mt. Mansfield State Forest, Vermont, June 30, 1964; 4334, Mt. Elmore State Park, July 16, 1964.

L. falcata is closely related to *L. praeclara* (Rehm) von Höhnelt, the type of the genus, and *L. phoenicis* (Chona & Munjal) Müller & Ahmad in spore shape. The other members of the genus have shorter, relatively broad spores. The eccentric to lateral position of the beak of *L. falcata* and the longer spores distinguish it from the other species. This fungus shows affinities to members of *Ceriospora* but differs by lacking spore appendages and by simpler apical appara-



Legend for Figures 1-8

Figs. 1-4. *Leiosphaerella falcata* Barr, sp. nov.: 1, perithecia beneath bark, 2, ascus, 3, ascus showing amyloid apical ring, 4, ascospores. Figs. 5-7. *Mycosphaerella linnaeae* Barr, sp. nov.: 5, ascostroma, 6, ascus, 7, ascospores. Fig. 8. *Keissleriella caudata* (Müller) Corbaz: ascospores. Figs. 1, 5, $\times 80$; figs. 2-4, 6-8, $\times 750$.

tus of the ascus. In the classification of Müller & von Arx (1962), *Leiosphaerella* is considered to be a member of the Amphisphaeriaceae.

Mycosphaerella linnaeae Barr, sp. nov., figures 5-7.

Ascstromata 80-100 μ diametro, 72-100 μ alta, immersa, gregaria, epiphylla; peridium 11-14.5 μ crassum, brunneum, hyphis brunneis. Asci 36-45 $\times$ 7.5-9 μ , oblonga, bitunicata, aparaphysata. Ascosporae 16.5-21 $\times$ 2-3 μ , fusiformae, hyalinae, uniseptatae, in duobus fasciculatae in ascis.

Specimen typicum in folia *Linnaeae borealis* L. var. *americanae* (Forbes) Rehd., a M.E. Barr lectus, n. 3831, prope "Millbrook Trail, Jefferson, White Mts. Nat. Forest, New Hampshire, July 6, 1963", in herbario Univ. Mass. depositum.

Ascstromata 80-100 μ in diameter, 72-110 μ high, globose, slightly depressed or conical, immersed in leaf tissue, with broad blunt apex

erumpent through upper epidermis, scattered thickly and evenly over most of leaf, wall thin, 11-14.5 μ wide, two to three layers of dark brown, polygonal cells, compressed hyaline cell layers toward interior, brown hyphae copious in leaf tissues. Asci 36-45 $\times$ 7.5-9 μ , oblong, apex rounded, base foot-like, wall double, thickened above, numerous in a fascicle, aparaphysate. Ascospores 16.5-21 $\times$ 2-3 μ , greenish hyaline, fusiform, ends pointed, straight to curved, one-septate in middle, not constricted at septum, wall thin and smooth, contents guttulate or with two globules in each cell, overlapping in two fascicles in the ascus.

On overwintered leaves of *Linnaea borealis* var. *americana*.

Material examined: Barr 3831 (type), Millbrook Trail, Jefferson, White Mts. Nat. Forest, New Hampshire, July 6, 1963; 1906, woods near chalet, Mt. Albert, Gaspé Prov. Park, Quebec, July 6, 1957.

A species of *Cercospora* is intimately associated with *M. linnaeae*, and I suggest that it may form part of the life cycle of this species. This *Cercospora* has conidiophores short, brown, septate, erumpent through upper leaf epidermis, often arising from apex of young ascostromata; conidia 24-54 $\times$ 2 μ , greenish hyaline, cylindrical, ends rounded, several-septate, contents guttulate. I have found no records of *Cercospora* on *Linnaea* (Chupp, 1953).

At least twenty-four species of *Mycosphaerella* have been described on members of the Caprifoliaceae, but only two were reported on *Linnaea*. *M. minor* (Karst.) Johans. has smaller ascostromata, broadly saccate asci and clavate ascospores 11-12 $\times$ 4 μ . No measurements have been given for *Sphaerella leightonii* (Berk. & Br.) Cooke, but ascospore shape and septation is quite different from that of *M. linnaeae*. As described in the literature, the other species of *Mycosphaerella* on members of the Caprifoliaceae do not appear similar to Barr 3831 and 1906. *M. crepidophora* (Mont.) Rehm and *M. ebulina* Petrak have elongate ascospores and seem most closely related to *M. linnaeae*. *M. crepidophora* develops in spots in living leaves of *Viburnum*; the ascospores are cylindrical or oblong and are somewhat broader than those of *M. linnaeae*. *M. ebulina* occurs on dead leaves of *Sambucus*. The ascostromata are densely gregarious to form angular black spots, asci are larger, and ascospores broader than in *M. linnaeae*. The broad apex of

the ascostromata and elongate, narrow fusoid ascospores are distinguishing characters of *M. linnaeae*.

Plagiostigme petrakii Müller, Sydowia 18: 90. 1965.

Plagiophiale petrakii (Müller) Petrak, Sydowia 18: 387, 1965.

Material examined: *Barr 4094*, on overwintered leaves of *Polygonum viviparum*, Alpine Gardens, Mt. Washington, New Hampshire, August 19, 1963.

This rare and distinctive fungus has been illustrated and described recently by Müller (1965), who made several collections of it on *Polygonum viviparum* from the Swiss and Italian Alps. Petrak (1955) was first to collect *P. petrakii*, but thought it to be identical with *Sphaerella eucarpa* Karst. At that time he erected the genus *Plagiophiale* for the species. However, *Sphaerella eucarpa* Karst. is a species of *Wettsteinina* (Barr 1959, Müller and von Arx 1962), and therefore *Plagiophiale* Petrak is a nomenclatural synonym of *Wettsteinina*. Müller (1965) has discussed in detail the generic position of the species on *Polygonum*. The North American material appears to be identical in all respects with that described from Europe.

Plectosphaera salicis (Fckl.) v. Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11(1): 204. 1954.

Material examined: *Barr 3928*, *Salix* twigs, South Conway, New Hampshire, July 18, 1963.

This appears to be the first record of *P. salicis* in North America. According to the literature, this pyrenomycete has been found previously only in Europe. My collection agrees with the description and figure in von Arx and Müller (1954).

Podosphaera clandestina (Wallr. ex Fr.) Lév. Ann. Sci. Nat. Bot. III, 15: 36. 1851, var. *clandestina*

Material examined: *Barr 4578*, *Vaccinium angustifolium*, top of Mt. Mansfield, Vermont, August 28, 1964; *4583*, *V. uliginosum*, data as above; *4585*, *Ledum groenlandicum*, data as above.

This minute powdery mildew has been recorded only rarely on members of the Ericaceae, chiefly species of *Vaccinium*, and never, as far as I could determine, on *Ledum*.

The specimens are in close accord with the description of *P. oxyacanthae* var. *oxyacanthae* in Salmon (1900).

Thaxteria fusca (Fckl.) Booth, The Naturalist, London, p. 90. 1958.
Sphaeria phaeostromoides Peck, N. Y. State Mus. Rep. 28: 77. 1876.

Chaetosphaeria phaeostromoides (Peck) Sacc. Syll. Fung. 2: 93. 1883.

Chaetosphaeria phaeostroma var. *phaeostromoides* (Peck) Ell. & Everh. North Amer. Pyreno., p. 160. 1892.

Material examined: *Barr 4041*, on fallen beech, near Sawyer Rock Picnic Area, White Mts. Nat. Forest, **New Hampshire**, August 10, 1963; *C. H. Peck*, on decorticated *Acer*, North Greenbush, **New York**, September 1874 (type of *Sphaeria phaeostromoides* Peck, NYS).

The collections cited above agree with Booth's (1958) description and figures of *T. fusca*, and bear both conidial and perithecial stages. Ellis and Everhart (1892) cited a collection from **Missouri**, but otherwise the fungus appears to be collected rarely. The genus *Thaxteria* is a member of the Coronophoraceae.

LITERATURE CITED

- ARX, A. J. VON and E. MÜLLER. 1954. Die Gattungen der amero-sporen Pyrenomyceten. Beitr. Kryptgamenfl. Schweiz 11(1): 1-434.
- BARR, M. E. 1959. Northern Pyrenomycetes I. Canadian Eastern Arctic. Contrib. Inst. Bot. Univ. Montreal 73: 1-101.
- BOOTH, C. 1958. The genera *Chaetosphaeria* and *Thaxteria* in Britain. The Naturalist, 83-90.
- CHUPP, C. 1953. A monograph of the fungus genus *Cercospora*. Ithaca, N. Y. 667 pp.
- ELLIS, J. B. and B. M. EVERHART. 1892. North American Pyrenomycetes. Newfield, N. J.
- FAVRE, J. 1955. Les Champignons Supérieurs de la Zone Alpine du Parc National Suisse. Rés. Rech. scient. entr. Parc Nat. Suisse 5: 1-212.
- HESLER, L. R. 1949. Notes on Southern Appalachian Fungi, VIII. Jour. Tenn. Acad. Sci. 24: 81-93.
- HESLER, L. R. and A. H. SMITH. 1963. North American Species of *Hygrophorus*. Knoxville, Tenn. 416 pp.

- LANGE, M. 1955. Macromycetes Part II. Meddelelser om Grønland 147(11): 1-69.
- LANGE, M. 1957. Macromycetes Part III. Meddelelser om Grønland 148(2): 1-125.
- MÜLLER, E. 1965. Beobachtungen an Ascomyceten. Sydowia 18: 86-105.
- MÜLLER, E. and A. J. VON ARX. 1962. Die Gattungen der didymosporen Pyrenomyceten. Beitr. Krypt. Fl. Schweiz, 11(2): 1-922.
- PETRAK, F. 1955. *Plagiophiale* nov. gen., eine neue Gattung der sphaerialen Ascomyceten. Sydowia 9: 585-587.
- SALMON, E. S. 1900. A monograph of the Erysiphaceae. Torrey Bot. Club Mem. 9: 1-292.
- SMITH, A. H. 1957a. A contribution toward a monograph of *Phaeocollybia*. Brittonia 9: 196-217.
- 1957b. Additional new or unusual North American agarics. Sydowia, Beih. 1 (Festschr. f. Franz Petrak): 46-61.
- SINGER, R. 1962. The Agaricales in Modern Taxonomy, 2nd ed. Weinheim. 915 pp.

NOTES ON RAFINESQUE'S SPECIES OF *LECHEA* (CISTACEAE)

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It was suggested in an earlier paper (Wilbur & Daoud, 1961) that some of the twenty species of *Lechea* published by Rafinesque (1836) would eventually prove identifiable and that their names would replace binomials then current. This may have seemed an unwarranted assumption since three careful students of this technical genus had diligently studied Rafinesque's monograph and concluded that the descriptions were not adequate to identify the species intended with any degree of confidence. Leggett (1878) republished much of Rafinesque's monograph and suggested the possible identity of several of the taxa. Britton (1894) indicated that he had worked closely with Leggett in attempting to unravel the problems of the genus and together they had "pored over Rafinesque's monograph". They finally concluded that "unless type specimens could be found, there could be no certainty" in applying any of the names. Hodgdon (1938:30) suggested that Rafinesque's "perplexing" monograph left the genus in a "deplorable state" and claimed to have been able to identify only four of Rafinesque's twenty new binomials.

I believe however that the majority of Rafinesque's species of *Lechea* can be identified with considerable certainty even in the absence of types by comparing his descriptions with the species known to occur in the areas mentioned in the original publication. The results of this analysis are presented in the following paragraphs presented in the same order as Rafinesque's monograph (1836) and followed chronologically by his other papers dealing with the genus. Unfortunately, for stability's sake, three of Rafinesque's

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binomials must replace those of species long known by later names.

1. *Lechea pulchella* Raf., New Fl. N. Am. 1: 91. 1836.

Rafinesque definitely mentioned *L. pulchella* only from the pine barrens of New Jersey although suggesting that its range probably extended to the south. The species was described as being "quite smooth" and, as a member of Rafinesque's subgenus *Menandra*, it can be assumed that its outer sepals were noticeably shorter than the inner, a feature which helps to narrow the list of possible species to four. Of the seven species of *Lechea* known from New Jersey, only *L. maritima* Legg., *L. intermedia* Legg. ex Britt., *L. leggettii* Britt. & Holl. and usually *L. racemulosa* Michx. have external sepals exceeded by the inner. *Lechea maritima* may be safely discounted as a suspect as it could never be described as "quite smooth" even upon the most superficial observation and its cauline leaves tend to be whorled and not "scattered." Rafinesque described the leaves of *L. pulchella* as "scattered long linear" and its capsules as "obovate." These features make it possible to exclude *L. racemulosa* from consideration for its principal or lower and median cauline leaves are commonly opposite or even whorled and elliptic to lanceolate or even oblanceolate and perhaps more significantly it possesses a barrel-shaped or cylindrical capsule. Rafinesque's subgenus *Menandra* was described as having seeds 1-3 in number which agrees with the number characteristic of *L. leggettii* but not with the 4-6 seeds characteristic of *L. intermedia*. Furthermore *L. leggettii* is known from the New Jersey pine barrens while *L. intermedia* apparently is not. Leggett (1878: 247) questioningly suggested that Rafinesque's *L. pulchella* was the same as the species then called "*L. minor* Lam." which is what has recently been called *L. leggettii*. Leggett (1878: 250) twice encountered in the pine barrens "an abnormally smooth *Lechea*" which pretty well matched Rafinesque's description. These smooth plants were what is now called *L. leggettii*. Accompanying the original publica-

tion of *L. leggettii* the name var. *pulchella* was appended with *L. pulchella* Raf. questioningly listed in synonymy indicating Britton's earlier similar suspicions.

The evidence seems sufficiently convincing that I do not hesitate to take up Rafinesque's binomial for the species most recently known as *L. leggettii*. New combinations for the varieties recognized by Hodgdon are not made for I am not convinced that these tendencies represent biological varieties or subspecies. Rafinesque (1836: 91) named three varieties based upon the luxuriousness of the plants and the shape of the inflorescence. These varieties were var. *minor* Raf., var. *elegans* Raf. and var. *pyramidalis* Raf.

2. *Lechea cinerea* Raf., New Fl. N. Am. 1: 91. 1836.

Leggett (1878: 250) felt that Rafinesque's description was a "pretty correct" one for the species he had previously distributed as *L. torreyi*. He noted however that there were 3-seeded and 6-seeded forms of the species and hoped that his proposed *L. torreyi* would prove distinct. Hodgdon (1938: 106-107) discussed Rafinesque's description and concluded that it was apparently based upon two or more species. The original description includes nothing that would suggest to me that Rafinesque had both *L. torreyi* and *L. patula* as seemed likely to Hodgdon but the point is academic. Rafinesque parenthetically placed *L. thymifolia* Michx. in synonymy of his own *L. cinerea* and again in closing mentioned the possibility that it was "the real *thymifolia*." Rafinesque's binomial hence is illegitimate as nomenclaturally superfluous when published according to the International Code (Article 63). The fact that Michaux's binomial is actually a synonym of *L. minor* L. does not alter the fact that Rafinesque first placed Michaux's name unequivocally in the synonymy of his own species.

3. *Lechea ternifolia* Raf., New Fl. N. Am. 1: 91. 1836.

Rafinesque stated that his *L. ternifolia* from "Virginia, New Jersey and probably elsewhere" "must be the real

L. racemulosa” of Michaux. Both Rafinesque and Michaux quote the same Gronovian polynomial. And Rafinesque’s description itself (“stem . . . adpressed pubescent, leaves and branches mostly ternate cuneate acute ciliate nearly smooth; racemes paniculate lax nearly naked, peduncles elongate, capsules oblong”) indicates that *Lechea ternifolia* Raf. can be placed with confidence in the synonymy of *L. racemulosa* Michx. Leggett (1878: 247) with some question and Grosser (1894: 135) unequivocally placed Rafinesque’s binomial in the synonymy of Michaux’s species while Hodgdon (1938) did not mention it.

4. *Lechea furfuracea* Raf., New Fl. N. Am. 1: 92. 1836.

Leggett stated (1878: 250) that he had “never seen anything to which this description would apply.” No one else has been able to suggest what species Rafinesque had from “Kentucky and Illinois” with “mealy pubescence and globose capsules,” very short external calyx-lobes, and rounded internal and “narrow linear scattered nearly obtuse” leaves. According to the most authoritative listings of *Lechea* in Illinois (Jones & Fuller, 1955) and in Kentucky (Braun, 1943) there are in fact no species known to be common to both states possessing external calyx-lobes shorter than the inner. *Lechea racemulosa* Michx. is the only species from Kentucky whose calyx approximates Rafinesque’s description and its capsule and foliage would definitely exclude it as a possible synonym of *L. furfuracea*. The three species from Illinois with appreciably shorter external than inner sepals are *L. stricta* Legg., *L. intermedia* Legg. and *L. leggettii* Britt. & Holl. Rafinesque’s description is not detailed enough to permit me to determine which species he had.

5. *Lechea laxiflora* Raf., New Fl. N. Am. 1: 92. 1836.

Rafinesque’s description seems certainly to apply to the species long known as *L. leggettii*. Leggett (1878: 247) thought it probably was “*L. minor* Lam.” which was the name by which *L. leggettii* was known in the later nine-

teenth century. Rafinesque found this species in "the New Jersey Pine Woods with *L. pulchella*" to which he felt it closely related. The more significant points in Rafinesque's description are as follows: "smooth . . . branches lax, leaves scattered linear cuneate acuminate ciliate; racemes scattered lax, flowers remote naked, pedicels elongate, calix and capsules ovate." I recommend (see No. 1 above) that *L. pulchella* be adopted as the earliest name for this species with *L. laxiflora* placed in its synonymy. Rafinesque also distinguished a var. *brevifolia* with reddish rather than greenish flowers and shorter, more cuneate, less ciliate leaves. Rafinesque indicated that the principal difference between this species and his *L. pulchella* was chiefly in the leaves which in *L. pulchella* were "scattered long linear acute" and by inference eciliate in contrast to the acuminate, ciliate leaves of *L. laxiflora*.

6. *Lechea tenuifolia* Michx., Fl. Bor.-Am. 1: 77. 1803.

Rafinesque's account is largely a translation of Michaux's original description. It is placed by Rafinesque with those species with short external sepals while the species to which we apply the name has external calyx lobes equaling or more commonly longer than the inner. Rafinesque cited no localities other than the Santee River which had been cited in Michaux's original account so it is not certain whether Rafinesque had actually seen specimens of this species in spite of his statement that he had "specimens of all of the described species." Perhaps Rafinesque placed it with the species of *Lechea* with short calyx-lobes since Elliott (Sk. Bot. S. C. & Ga. 1: 185. 1816.) implied that this species had no external calyx and this statement was included by Rafinesque. Elliott in turn had been misled by Walter (Fl. Car. 83. 1788) who reported there was no outer calyx in his *L. juncifolia*, a species which has never been satisfactorily identified.

6[a]. *Lechea verna* Raf., New Fl. N. Am. 1: 92. 1836.

This binomial was published as a substitute name ("6. L.

tenuifolia Mx. Elliot or *L. verna* Raf. *L. juncifolia* Walter.") and is therefore illegitimate.

7. *Lechea recurvata* Raf. New Fl. N. Am. 1: 93. 1836.

This species was placed by Rafinesque in his subgenus *Menandra* possessing short external calyx-lobes. It was said to possess globose capsules and to occur "in Carolina and Virginia." I believe that this is the species referred to in the most recent monographs of Britton (1894) and Hodgdon (1938) as *L. leggettii*. If my interpretations of Rafinesque's species are correct, *Lechea pulchella*, *L. laxiflora* and *L. recurvata* are all prior names for the species now called *L. leggettii*. There are only two *Lecheas* common to both Virginia and "Carolina" possessing external calyx-lobes shorter than the inner; these two are *L. racemulosa* and *L. leggettii*. The described globose capsules of *L. recurvata* would seem to exclude *L. racemulosa* as a possibility although, judging by the following features mentioned "branches opposite and ternate, leaves broad oblong acute at both ends ciliate," it might seem a better match for Rafinesque's description than *L. leggettii*.

8. *Lechea mucronata* Raf., Précis des Découvertes Somiol. 37. 1814.

To my knowledge only House (New York St. Mus. Bull. 254: 497. 1924) has taken up this name although Robinson (Syn. Fl. N. Am. 1: 192. 1895) and Grosser (1903: 135) both placed it unquestioningly in the synonymy of *L. major* in the sense of Michaux but not of Linnaeus. *Lechea major* sensu Michaux, Robinson and Grosser is synonymous with *L. villosa* Ell. Hodgdon, the most recent monographer of the genus, concluded that there was not enough evidence presented in Rafinesque's original description to warrant the displacement of Elliott's *L. villosa*, a "well-characterized and clearly typified name." Rafinesque's original description is presented below in full so that others may form their own conclusions independent of my own interpretation. I am

indebted to Mrs. Lazella Schwarten, Librarian of the Harvard Herbaria, for making a copy of it available.

120. *Lechea mucronata*. Poilue, tige droite et simple, feuilles oblongues-cunéiformes mucronées, fleurs en grappe composée, bractéolées, bractées oblongues aigues. *Dans les bois du N. Jersey.*

Hodgdon stated (1938: 56) that the "only possible diagnostic features of Rafinesque's description are "feuilles oblongues-cunéiformes mucronées, fleur en grappe composée." He concluded that the statement concerning the arrangement of the flowers "might apply to most members of the genus" and that the described leaf shape would apply "equally well to *L. minor* as to *L. villosa*." The description's most definitive word in my opinion is "poilue," and in addition the habitat and geographical location certainly considerably narrow the number of possibilities.

"Poilue" meaning "shaggy, hairy or pilose" best describes the species recently called *L. villosa*. The features mentioned in the brief description single out the species long incorrectly known as *L. major* and more recently known as *L. villosa*. There are seven species of *Lechea* known from New Jersey: *L. minor*, *L. tenuifolia*, *L. racemulosa*, *L. maritima*, *L. leggettii*, *L. intermedia* and *L. villosa*. Of these seven the last mentioned alone seems indicated by Rafinesque's description of 1814. *Lechea maritima*, *L. leggettii* and *L. intermedia* all possess external sepals conspicuously shorter than the internal which would exclude them from consideration. Of the seven species of *Lechea* mentioned above found in New Jersey the term "poilue" would seem to me to exclude all but *L. villosa* and perhaps *L. maritima*. The description of the leaves, although not definitive, would seem to exclude *L. maritima* but include *L. villosa* whose leaves are often mucronate. It is true that the leaves of *L. minor* sometimes would fit Rafinesque's description as indicated by Hodgdon but certainly "poilue" would scarcely be used to describe the subappressed pubescence of that species.

Rafinesque (1836: 93) more fully described his *L. mucro-*

nata indicating it to be the same as the *L. villosa* of Elliott from whom he had received specimens. Included are statements puzzling even to a casual student of the group (e.g. "capsules ovate villose") but sufficient, I believe, to convince one that Rafinesque was indeed describing, although perhaps poorly, the species called *L. villosa* by Elliott. In passing it may be noted that the capsules of all species of *Lechea* are glabrous. There actually seems to be nothing other than prejudice why we should not take up Rafinesque's name for this species since it has two years priority over Elliott's *L. villosa*. Rafinesque (1836: 93) briefly described three varieties all of which came from the extensive area of Hodgdon's var. *typica*. The three varieties were var. *simplex*, var. *ramosa* and var. *sessiliflora*. New combinations have not been made for Hodgdon's var. *macrotheca* ranging from central Nebraska south into Texas or his var. *schaffneri* from northeastern Mexico since I have not seen enough material to form an opinion as to the merits of these proposed taxa.

9. *Lechea heterophylla* Raf., New Fl. N. Am. 1: 93. 1836.

Rafinesque described this species from Kentucky and Illinois as having an appressed pubescent stem and acute, carinate inner sepals about equaling the external. Neither Leggett (1878: 248) nor Grosser (1903: 140) would hazard a guess as to what it might be. The three species common to Kentucky and Illinois possessing external sepals at least occasionally equaling the inner are *Lechea villosa* Ell., *L. tenuifolia* Michx. and *L. minor* L. The shaggy pubescence of the stem of *L. villosa* would exclude it from further consideration. The leaves were described as "commonly ternate, lower obovate, subsessile, upper cuneate and linear petiolate acute smooth." I believe this a better approximation of the greater variation shown between the lower and upper leaves of *L. minor* than the comparatively uniform condition exhibited by *L. tenuifolia*. The acute inner sepals on the other hand are a better fit for the "subacute" condi-

tion of *L. tenuifolia* than the "obtuse" inner sepals of *L. minor*. I suspect Rafinesque was describing *L. minor* since the conspicuous difference in the foliage was less subject to error by Rafinesque than the shape of the apex of the inner sepals. Rafinesque placed "*L. minor* Smith" in the synonymy of his *L. heterophylla* but his description would exclude the villous species that was apparently considered *L. minor* by J. E. Smith. Britton (1895: 248) has demonstrated that Smith's *L. minor* was the species which Elliott called *L. villosa*. Rafinesque published the following three varieties of this species: var. *major* Raf., *op. cit.* 94. 1836, var. *minor* Raf., *l.c.* and var. *parviflora* Raf., *l.c.* and only the last of these was even briefly described.

10. *Lechea glomerata* Raf., New Fl. N. Am. 1: 94. 1836.

Rafinesque's description of this species from the "Aplachian mts." strongly points to *L. mucronata* Raf. (= *L. villosa*) except for his characterization of it as "smooth." The carinate sepals, short pedicellate, glomerate flowers, linear external sepals about equaling the internal, the trigonous calyx surrounding the subglobose capsule and the mucronate, petiolate leaves are all indicative of *L. villosa* but that species is apparently always densely villous to spreading pilose. Leggett (1878), Grosser (1903) and Hodgdon (1938) have all found it impossible to identify Rafinesque's description and I claim no greater success.

11. *Lechea corymbosa* Raf., New Fl. N. Am. 1: 94. 1836.

The description of this species from the "Alleghany" Mountains, belonging to Rafinesque's subgenus *Lechea*, a group characterized by the external and internal sepals equaling one another, is most suggestive of *L. villosa* Ell., a later synonym of *L. mucronata* Raf. (see No. 8 above). The original description of *L. corymbosa* ("stem . . . pilose . . . , leaves petiolate broad oblong nearly obtuse, . . . flowers corymbose, pedicels equal to flowers, sepals round concave, ext. linear, capsules globose . . . 6 to 12 inches high

. . . capsules large with 3 to 6 seeds . . . ") is not especially definitive but I believe it is most suggestive of *L. mucronata* of the species occurring in the Alleghenies.

12. *Lechea surculosa* Raf., New Fl. N. Am. 1: 94. 1836.

Leggett (1878: 248) questioningly suggested that this description might be *Lechea minor* [in the sense of] Lam. which is the species most recently called *L. leggettii* Britt. & Hollick. This seems an unlikely identification since *L. leggettii* is characterized by its external sepals being pronouncedly shorter than the inner while *L. surculosa*, as a member of Rafinesque's subgenus *Lechea*, would be expected to have the inner and outer sepals of approximately equal length. It is certainly true that one can not place the species of *Lechea* into three groups depending on whether the external sepals are shorter, equaling, or longer than the internal since there is too much variation in the relative length of the sepals in several species but the external sepals of *L. leggettii* are always clearly appreciably shorter than the inner. Rafinesque's species was described as possessing "acute" inner sepals while those of *L. leggettii* are clearly obtuse. There are other discrepancies, but the two mentioned are sufficient to discount completely Leggett's suggestion.

Rafinesque knew this plant from "Pennsylvania on dry hills" and indicated it was the *L. minor* of some authors. I believe the description of *L. surculosa* best matches the characteristics of *L. racemulosa*, a species whose external sepals range from obviously shorter than the inner sepals to equaling them. The inner sepals of *L. racemulosa*, according to Hodgdon's description, vary from "subacute to obtuse" while Rafinesque described those of *L. surculosa* as "acute." The capsule of *L. racemulosa* was described in Hodgdon's monograph as "slenderly ellipsoid to slenderly ovoid" while Rafinesque said those of *L. surculosa* were "ovate." Rafinesque described the sterile stems of *L. surculosa* as "pilose with leaves ternate ovatooblong acute ciliate"

which is a reasonably close approximation of Hodgdon's description of the basal shoot of *L. racemulosa*: "basal leaves frequently verticillate, . . . oblong-ovate to elliptic-lanceolate, acute to slightly mucronulate . . . prominently spreading-pilose to villous on the margins." The other species of *Lechea* from Pennsylvania with external lobes approximately equaling the inner at least occasionally (*L. villosa*, *L. tenuifolia* and *L. minor*) have characters which compare unfavorably with those delineated by Rafinesque. The "smooth" branches and "linear" leaves of Rafinesque's *L. surculosa* are sufficient to discount it as a possible synonym of *L. villosa* (= *L. mucronata*). The basal leaves of *L. tenuifolia* were described by Hodgdon (1938: 87) as "narrowly lanceolate or oblanceolate to linear" which certainly implies a much narrower leaf than does Rafinesque's description and the cauline leaves of *L. tenuifolia* are described by Hodgdon as "scattered" while Rafinesque described those of *L. surculosa* as "opposite and alternate." I believe then that *L. surculosa* Raf. is an ecologically modified form of *L. racemulosa* Michx. and that it should be placed in its synonymy.

This binomial first appeared three years earlier in Rafinesque's *Herb. Raf.* 68. 1833 but without description.

13. *Lechea revoluta* Raf., *New Fl. N. Am.* 1: 94. 1836.

Rafinesque stated that this species is the *Lechea* "minor of Lin. not of Smith nor other Authors" and that the "description is taken from Linnaeus altogether, and agrees very well with some specimens [that Rafinesque had] from the Alleghenies of Pennsylvania." Nomenclaturally the binomial is a synonym of *Lechea minor* L. Rafinesque provided a new name since J. E. Smith had indicated that Linnaeus had confounded several species within his *L. minor*.

14. *Lechea virgata* Raf., *New Fl. N. Am.* 1: 95. 1836.

This Alleghenian species was described as possessing

pubescent stems, opposite, whorled or even scattered, petiolate, linear, cuneate, ciliate, acuminate leaves with acute, carinate inner sepals, pedicels equaling the flower-length and ovate capsules. As a member of subgenus *Lechea*, it can be safely assumed that its external sepals equaled the inner. There are four species within the area of the Allegheny Mountains whose external sepals may commonly or occasionally equal the internal ones. These four species are *Lechea minor* L., *L. racemulosa* Michx., *L. tenuifolia* Michx. and what has been most recently referred as *L. villosa* Ell. The description is an unusually full one for Rafinesque and the above mentioned characters seems best to describe *L. tenuifolia* Michx. of the four species listed above from the Alleghenies whose external sepals commonly or occasionally equal the inner. The linear leaves, which are the only type mentioned for *L. virgata*, are sufficient to exclude *L. villosa* and *L. minor* from further consideration. The inner sepals of *L. racemulosa* are non-carinate while those of *L. virgata* were described as carinate. Two varieties were appended to this species with brief description: var. *breviflora* and var. *bracteata*.

15. *Lechea floridana* Raf., New Fl. N. Am. 1: 95. 1836.

There are eight species of *Lechea* known from Florida (Hodgdon, 1938; Wilbur & Daoud, 1961). Five of these (*L. deckertii* Small, *L. leggettii* Britt. & Holl., a later synonym of *L. pulchella* Raf. as is pointed out in no. 1 above, *L. torreyi* Legg. ex Britt., *L. divaricata* Shuttlew. ex Britt. and *L. cernua* Small) possess external sepals conspicuously shorter than the internal. The three others (*L. villosa* Ell., a later synonym of *L. mucronata* Raf. as is discussed in no. 8 above, *L. minor* L. and *L. patula* Legg.) all possess external sepals conspicuously shorter than the internal, as was described by Rafinesque for his *L. floridana*. None of these three species is "smooth" as mentioned by Rafinesque but certainly the copious, spreading villosity of *L. mucronata* (= *L. villosa*) together with its oblanceolate leaves excludes it from consideration. The appressed pubescence of

L. patula and *L. minor* could easily have been overlooked, especially if the specimens were aged, by an observer as hasty and superficial as Rafinesque often gives evidence as having been. The leaves of *L. floridana* were said to be "scattered, minute linear" which is more suggestive of *L. patula* than of *L. minor*. The external calyx of *L. floridana* was implied to equal the inner which is sometimes true of both *L. patula* and *L. minor*. The external sepals of *L. patula* most frequently are a little shorter than the inner but range up to slightly longer while those of *L. minor* rarely are as short as the inner and most frequently are conspicuously longer. The capsules of *L. floridana* were said to be ovate which is not a very apt description for the capsule of either species but, interpreted as "ovoid," not impossibly bad for either. I suspect this to be a form of *L. patula* Leggett but due to the discrepancies mentioned would not feel its identity completely certain.

16. *Lechea secundiflora* Raf., New Fl. N. Am. 1: 95. 1836.

This species came from "the glades of West Kentucky" making it impossible that its binomial could ever displace that of any of the four species definitely known from that state since each has an older name. The known species are *L. villosa* Ell., a later synonym of *L. mucronata* Raf., *L. minor* L., *L. tenuifolia* Michx. and *L. racemulosa* Michx. Rafinesque's description fits none well and there are mentioned features that would exclude each of the geographical possibilities. Grosser (1903: 135) placed Rafinesque's name in the synonymy of *L. minor* but his description of "leaves scattered, lax narrow linear, . . . flowers remote secund" would, as pointed out by Hodgdon (1938: 60), make that an unlikely choice. Hodgdon (1938: 88) placed Rafinesque's binomial in the synonymy of *L. tenuifolia* Michx. although the description of the capsules as "oblong" and the inner calyx as "lanceolate" causes considerable doubt as does Rafinesque's description of the plant as "smooth." I am unable to identify the binomial and believe the mentioned discrepancies are of such magnitude as to prevent one from

assigning it with confidence to the synonymy of any species known from Kentucky.

17. *Lechea pauciflora* Raf., New Fl. N. Am. 1: 96. 1836.

The identity of the plants described by Rafinesque under this binomial from "Near the Sea Shore in Long Island and New Jersey" was questioningly suggested by Leggett (1878: 250) to be *L. thymifolia* in the sense of Pursh which is *L. maritima* Legg., a species whose external sepals are much shorter than the heavily appressed-pilose internal calyx. Rafinesque placed *L. pauciflora* in his subgenus *Eudiexa*, characterized by outer sepals exceeding the inner, and in the diagnosis of the species specifically stated "sepals smooth, external a little longer." Grosser (1903: 135) assigned Rafinesque's binomial to the synonymy of *L. minor* L., a disposition to which Hodgdon (1938: 60) objected, feeling the described 3-inch specimens to be an "ecological variant of some other species" whose identity was undecipherable because of the incompleteness of the original publication. The only two species apparently known from both Long Island and New Jersey with outer sepals longer than the inner and "adpressed pubescent" stems are *L. tenuifolia* Michx. and *L. minor* L. Rafinesque described the capsules of his *L. pauciflora* as "globose" which among other features mentioned in the description would eliminate *L. minor*. The leaves of Rafinesque's species were described as "rather obtuse" which together with the "smooth" calyx makes it difficult to place this name in the synonymy of *L. tenuifolia* with which the description agrees in most other respects. Therefore I am unable to suggest the identity of this binomial.

18. *Lechea brevifolia* Raf., New Fl. N. Am. 1: 96. 1836.

Leggett (1879: 249) was "quite at a loss" as to what species Rafinesque's description might apply while Grosser (1903: 135) placed the binomial in the synonymy of *L. minor* L. without discussion. Hodgdon (1938: 60), while

admitting that much of Rafinesque's description applied to *L. minor*, felt that the diagnosis of "flowers secund, pedicels equal" indicated confusion on the author's part. Hodgdon's objection on these grounds are difficult to understand for the flowers and fruit are sometimes secund as his own description of *L. minor* L. admits (p. 59 "fruit mostly clustered, at times scattered or even secund") and the 1-2 mm. long pedicels are often equal to one another or to the flowers. The species came from the "Mts. Apalaches" (Appalachian Mts.) and I believe it most probable that this binomial belongs in the synonymy of *L. minor*.

19. *Lechea uniflora* Raf., New Fl. N. Am. 1: 96. 1836.

Leggett (1878: 249) was unable to suggest what species Rafinesque was describing based upon 3-4 inch specimens from the mountains of Maryland possessing few leaves or flowers and longer outer sepals than inner and with a 6-seeded, globose capsule. Grosser (1903: 135) placed the binomial in the synonymy of *L. minor* L. but Hodgdon (1938: 61) disagreed with this placement concluding that it was "hopeless to try to identify this particular one of Rafinesque's Lecheas." I am in total agreement with Hodgdon for I too am unable to suggest the identity of *L. uniflora*. There are too many features mentioned in its original description which are at complete variance with the characteristics of *L. minor* for us to accept Grosser's identification. To my knowledge a "smooth" specimen of *L. minor* with globose 6-seeded capsules has not been reported.

20. *Lechea stellata* Raf., New Fl. N. Am. 1: 96. 1836

I am in complete agreement with Leggett's decision (1878: 251) that this description is "undoubtedly the *L. thymifolia*" of Michaux which is a synonym of *L. minor* L. The more diagnostic portions of Rafinesque's description seem to be as follows: "Pilose . . . leaves 3-4 nate petiolate elliptic mucronulate, upper leaves alternate lanceolate; racemes foliose, . . . ext. sepals very long, capsules ovate-

oblong.” Both Grosser (1903: 135) and Hodgdon (1938: 61) considered *L. stellata* to be synonymous with *L. minor*, although the latter fails to place it formally in the synonymy of that species.

21. *Lechea sessiliflora* Raf., New Fl. N. Am. 1: 97. 1836.

Leggett (1878: 251) thought that the description accompanying this binomial might “possibly be *L. patula*” but no species known to him had sessile mature flowers. In spite of this, Index Kewensis equated Rafinesque’s binomial with *L. patula* Legg. and Grosser (1903: 138) unquestioningly placed it in the synonymy of that species. Hodgdon (1938: 63) felt that Rafinesque’s description could not be positively identified but that its sessile flowers and 3-9-seeded capsules obviously excluded the pedicellate, 1(2)-seeded *L. patula* as a possibility. However, since no *Lechea* is actually sessile, it would perhaps be only reasonable to interpret Rafinesque’s description as “subsessile” and consider short-pediceled species as possibilities. Also, since no known species of *Lechea* possesses more than 6 seeds, we had best treat the 3-9-seeded condition attributed by Rafinesque to his subgenus *Eudiexa* as an obvious error. It is well to note that Rafinesque did not mention seed-number in his diagnosis of *L. sessiliflora*; seed number was stated only in conjunction with the characterization of the subgenus.

There are five species known to be common to both Florida and Alabama: *Lechea villosa* Ell., *L. minor* L., *L. patula* Legg., *L. leggettii* Britt. and *L. torreyi* Legg. ex Britt. The two last-mentioned of these can be discounted as possibilities since their external sepals are considerably shorter than the internal and the reverse is clearly described as the state of *L. sessiliflora*. *Lechea villosa* can be eliminated from consideration since its shaggy-villous stems could never be described as “adpressed pilose” while both *L. minor* and *L. patula* both fit that characteristic. Rafinesque’s characterization of the species “branches diffuse virgate, leaves scattered . . . linear . . . ext. sepals linear not much longer . . .” all point most clearly to *L. patula* rather than to *L. minor*.

I believe that Leggett's suspicion as to the identity of *L. sessiliflora* has been fully confirmed. There is hence no reason not to take up *L. sessiliflora* Raf. which has forty-two years priority over Leggett's *L. patula*.

The remaining names proposed by Rafinesque are listed below:

Lechea linifolia Raf., Atl. Jour. 1: 18. 1832. *nom nud.*

Lechea paucifolia Raf., Atl. Jour. 1: 18. 1832. *nom. nud.*

Lechea mexicana Raf., Sylva Tell. 133. 1838.

Rafinesque provided this as a substitute name for *Helianthemum tripetalum* of Mexico no doubt because *tripetalum* was a pointless epithet in a genus characterized by three petals. The name is nomenclaturally superfluous and therefore illegitimate (Art. 63).

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LITERATURE CITED

- BRAUN, E. LUCY. 1943. *Lechea* in An Annotated Catalog of Spermatophytes of Kentucky. p. 93.
- BRITTON, N. L. 1894. A Revision of the Genus *Lechea*. Bull. Torrey Club 21: 244-253.
- GROSSER, W. 1903. *Lechea* in Engler's Das Pflanzenreich 14 (IV. 193): 133-140.
- HODGDON, A. R. 1938. A Taxonomic Study of *Lechea*. Rhodora 40: 29-69, 87-131. (Reprinted as Contrib. Gray Herb. 121.)
- JONES, G. N. & G. D. FULLER. 1955. *Lechea* in Vascular Plants of Illinois. pp. 328-329.
- LEGGETT, W. H. 1878. Rafinesque's *Lechea*. Bull. Torrey Club 6: 246-252.
- RAFINESQUE, C. S. 1836. Monograph of *Lechea*. New Flora and Bot. of N. Am. pp. 89-98.
- WILBUR, R. L. & H. S. DAOUD, 1961. The Genus *Lechea* (Cistaceae) in the Southeastern United States. Rhodora 63: 103-118.

GENTIANA PUBERULENTA SP. NOV., A KNOWN
BUT UNNAMED SPECIES OF THE
NORTH AMERICAN PRAIRIES¹

JAMES S. PRINGLE

The species which for the past century has been known as *Gentiana puberula* is one of the showiest of the North American gentians; Curtis (1959) called it "by all odds the most beautiful member of this famed genus in Wisconsin," and described its flowers as "unrivalled in the clarity and intensity of their deep blue color." It is a characteristic species of mesic and xeric prairie communities from Ohio west to Manitoba and Arkansas, and has been collected as far east as western New York and Maryland, as far south as Louisiana, and as far west as the Black Hills of South Dakota. Some authors have designated this species the "Prairie Gentian"; others have used the translation "Downy Gentian", although the puberulence is so minute that it is not a conspicuous feature to the casual observer.

Gentiana puberula Michx. Fl. Bor.-Am. 1:76. 1803 was based on a specimen Michaux had collected at "Fort Cheroquis" (Fort Massac) in present-day Massac County, Illinois, where he had spent part of the autumn of 1795. This specimen is preserved in the herbarium of the Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris, France. A photographic negative of this specimen was made available through the kindness of Prof. A. Aubréville and J. Leandri. This negative and enlarged prints have been placed in HAM. Duplicate prints have been deposited

¹In addition to those persons whose contributions are noted in the text, I should like to express my appreciation to Dr. A. J. Sharp of the University of Tennessee and Dr. J. M. Gillett and Mr. W. J. Cody of the Plant Research Institute, Canada Department of Agriculture, for their reviews of the manuscript, and to Dr. A. H. Moser of the University of Tennessee, for his checking the Latin description.

Contribution No. 5 from the Royal Botanical Gardens, Hamilton, Ontario, Canada.

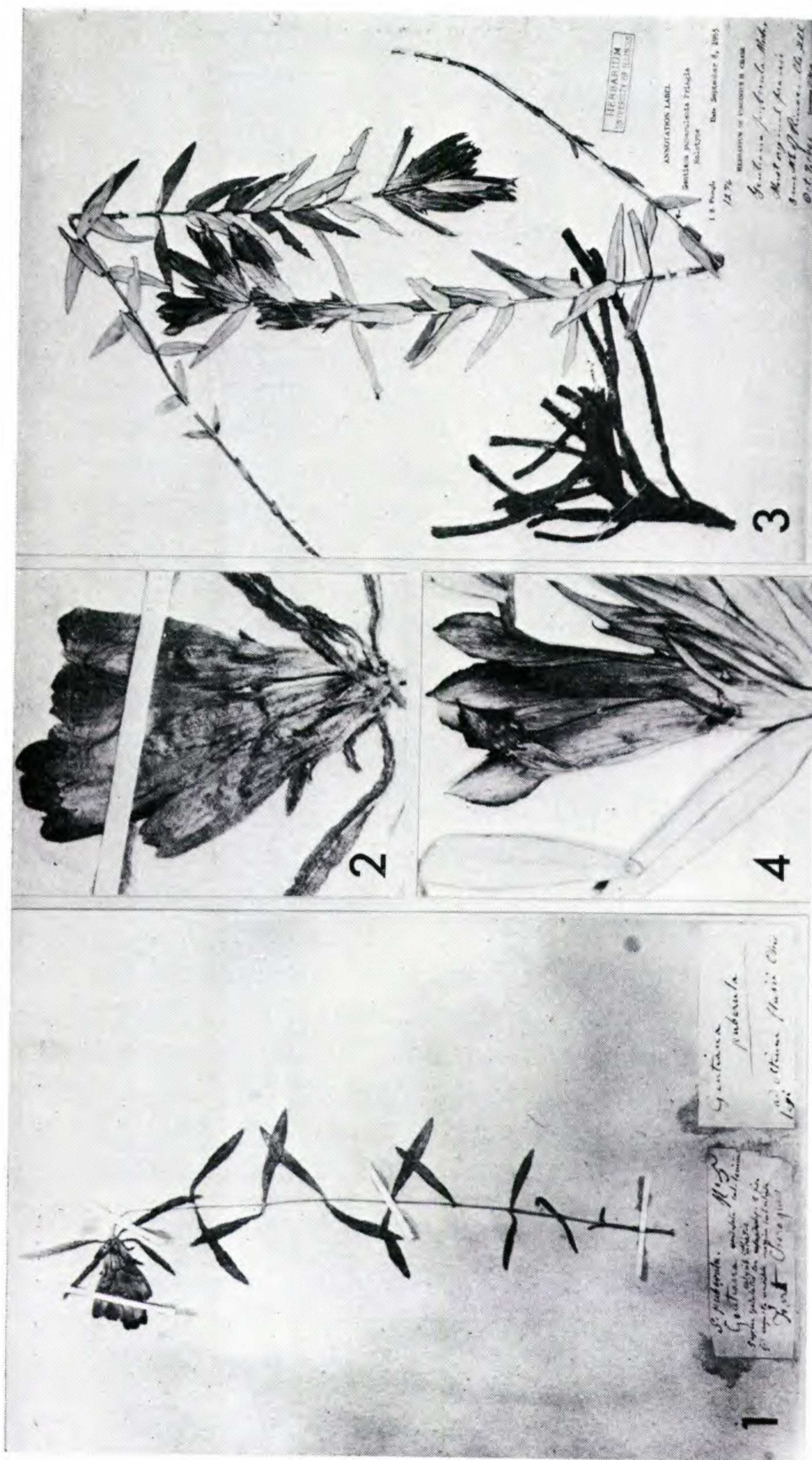


PLATE 1334

FIGS. 1 and 2. Type specimens of *Gentiana puberula* Michx. FIG. 1. Specimen and labels, X ca 0.2. FIG. 2. Flowers, X ca 0.9. FIGS. 3 and 4. Type specimen of *G. puberula* Pringle. FIG. 3. Complete specimen on herbarium sheet, with labels, X ca 0.2. FIG. 4. Flower on stem selected for type, X ca 0.9.

in DAO, GH, ILL, and WIS, and are reproduced here as Figures 1 and 2. The status of this specimen as the type is confirmed by the label in Michaux's handwriting on which both the collection data and the description correspond closely to those in Michaux's (1803) *Flora Boreali-Americana*.

The type specimen of *G. puberula* Michx. is clearly not a specimen of the species described under that name in recent manuals (e.g. Fernald, 1950, and Gleason & Cronquist, 1963), but is, instead, a specimen of *G. saponaria* L. which falls well within the range of variation commonly found in populations of that species. *Gentiana saponaria* is usually described as having glabrous stems, but individuals with puberulent stems are occasionally encountered throughout most of its range. Table 1 lists some of the conspicuous differences between the type specimen of *G. puberula* Michx. and the species hitherto commonly known as *G. puberula*, here designated *G. puberulenta*. The characters selected for use in Table 1 are those readily discernible in the photograph and ones which have been found valuable in the distinguishing of *Gentiana* species.

No scientific name appears to be available for the Prairie Gentian. Authors of floras of North America and treatises on the North American gentians published prior to 1848 seem not to have known this species (with the possible exception of Rafinesque, as noted below). Grisebach (1838, 1839, 1845), in his works on the Gentianaceae, tentatively assigned the name *G. puberula* Michx. to the synonymy of his *G. saponaria* β *linearis*. (The latter name was based on *G. linearis* Froel., the name of a distinct species with which Grisebach had confused narrow-leaved specimens of *G. saponaria*.) In so doing, Grisebach was following Pursh (1814), but he (1838) added that this interpretation might be incorrect, and that "it is desirable that this question should be determined by the inspection of Michaux's herbarium." From labels on mid-nineteenth-century collections of the Prairie Gentian, it appears that the first botanists to collect it called it *G. rubricaulis* Schwein. (a name properly applied to a more northern species), and that it is the basis

for the inclusion of "*Gentiana rubricaulis*" (without description) in some plant lists of that period (see Jones and Fuller, 1955).

Although many names for gentians were published by Rafinesque, it does not appear that any can be applied to this species. In certain parts the brief descriptions of *Gentiana shortiana*, *G. torreyana*, *G. rigida*, and *G. gracilis* (all in his Medical Flora, 1828) suggest the possibility that they were based on specimens of this species; however, each of the descriptions, when considered in its entirety, appears much more probably to have been based on *G. saponaria* L. In Rafinesque's (1837) Flora Telluriana these specific epithets appear in his genera *Pneumonanthe* and *Xolemia*; the descriptions of both genera contain material which is inapplicable to the Prairie Gentian, although applicable to *G. saponaria*. Probably Rafinesque never encountered this species, which was rare in the area of his field work and had been collected by few botanists at the time of his publishing. It is highly unlikely that any of these Rafinesque taxa will ever be typified by a specimen, since very few of the plant specimens collected by Rafinesque are extant. Dr. Ronald L. Stuckey, who has studied the herbarium (now in PH) of C. W. Short, to whom Rafinesque gave some specimens, reports that none of the specimens bear any of these names. John Torrey's *Gentiana* specimens (now in NY) were annotated by Rafinesque, but I found none of these names among the annotations.

Probably the earliest published description of the Prairie Gentian is that by Gray (1848) in the first edition of his Manual, in which it was designated *G. saponaria* β *puberula* (Michx.) Torr. & Gray. In later editions Gray recognized this taxon at the rank of species, as *G. puberula* Michx. Gray's treatment has generally been followed by later authors.

Thus, even though a number of descriptions of the Prairie Gentian have been published in the past, it is necessary to describe it here as a new species:

Gentiana puberulenta Pringle, sp. nov.

Herba perennis singulis vel pluribus caulibus suberectis longis 1-6 dm puberulentis subtiliter abundanterque. Folia lanceolato-oblonga interdum paene linearia prope basem latissima uninervia marginibus ciliatis saepe revolutis. Folia superiora longa 1.5-7 (-10.5) cm lata 4-18 (-30) mm. Flores paene sessiles 2-bracteati aggregati apud summum caulem et interdum de axillis pedicellati. Tubus calycis longus 7-18 mm. Lobi calycis lineares longi 4-18 (-25) mm lati 1-3 (-4) mm. Corolla atrocyanea (raro violacea vel rubro-violacea) vasi-formis certe se aperiens longa 3-6 cm. Lobi corollae ovati patentis longi 6-14 mm lati 4-10 mm marginibus saepe erosis. Partes liberae appendicium corollae longae 2.5-6 mm bifidae praeterea segmentibus laciniatis. Antherae non cohaerentes. Semina alata.

Type: *Chase 1276*, 3 mi. N.E. of Princeville, Peoria County, Illinois, 7 Oct. 1906 (ILL; *isotypes* DAO, ILL, KSC, MIN, NY, US).

A more extensive description of this species, along with a discussion of its distribution and probable relationships to other species, will be included in a forthcoming monograph by the author on *Gentiana*, section *Pneumonanthe*, in eastern North America.

No infraspecific taxa have been recognized within this species. The two named hybrids involving it are both typified by specimens, so the applications of the names *G. × bilingtonii* Farw. (pro sp.) (Pap. Mich. Acad. 1:96. 1923) and *G. × curtisii* Pringle (Trans. Wis. Acad. 53:277. 1964) remain unchanged. Their formulae, however, should be emended to *G. puberulenta* × *G. andrewsii* and *G. puberulenta* × *G. alba*, respectively.

LITERATURE CITED

- CURTIS, J. T. 1959. The Vegetation of Wisconsin: An Ordination of Plant Communities. The Univ. of Wisconsin Press, Madison.
- FERNALD, M. L. 1950. Gray's Manual of Botany. ed 8. American Book Co., New York.
- GLEASON, H. A., and A. CRONQUIST. 1963. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. D. Van Nostrand Co., Princeton.
- GRAY, A. 1848. A Manual of the Botany of the Northern United States . . . James Monroe & Co., Boston.

- GRISEBACH, A. H. R. 1838. Gentianeae Juss. *In* Hooker, W. J., *Flora Boreali-Americana* 2:54-71. Henry G. Bohn, London. [Reprinted 1960 as *Hist. Nat. Class.* 5. H. R. Engelmann (J. Cramer), Weinheim, and Wheldon & Wesley, Codicote.]
- . 1839. *Genera et Species Gentianearum*. J. G. Cotta, Stuttgart and Tubingen.
- . 1845. Gentianaceae. *In* Candolle, A. P. de, and A.L.P.P. de Candolle, *Prodromus Systematis Naturalis Regni Vegetabilis* . . . 9:38-141. Victor Masson, Paris.
- JONES, G. N., and H. J. FULLER. 1955. *Vascular Plants of Illinois*. The Univ. of Illinois Press, Urbana, and The Illinois State Museum, Springfield, Sci. Ser. vol. 6.
- MICHAUX, A. (L. C. M. Richard, ed.) 1803. *Flora Boreali-Americana* . . . Freres Levrault, Paris and Strasburg.
- PURSH, F. T. 1814. *Flora Americae Septentrionalis* . . . White, Cochrane, & Co., London.
- RAFINESQUE, C. S. 1828-1830. *Medical Flora* . . . Atkinson & Alexander, Philadelphia.
- . 1836-1837. *Flora Telluriana*. Publ. by the author, Philadelphia. (Photolith. 1946. Arnold Arboretum, Cambridge.)

ROYAL BOTANICAL GARDENS,
HAMILTON, ONTARIO, CANADA

TABLE 1. THE TYPE SPECIMEN OF *GENTIANA PUBERULA* MICHX.
CONTRASTED WITH *G. PUBERULENTA* PRINGLE

Type specimen of <i>G. puberula</i>	<i>G. puberulenta</i>
Leaves few and widely spaced.	Leaves many and crowded.
Leaves widest at or above the middle.	Leaves widest near the base.
Calyx lobes oblong, widest above the middle.	Calyx lobes linear.
Corolla lobes comprising about 10% of the total corolla length.	Corolla lobes comprising 20-25% of the total corolla length.
Corolla lobes widest at the base, less than twice as long as the appendages.	Corolla lobes ovate, more than twice as long as the appendages.

NEW CHROMOSOME NUMBERS IN ZINNIA AND SANVITALIA

ANDREW M. TORRES¹

In recent systematic papers concerning *Zinnia* (Torres 1962, 1963) and *Sanvitalia* (Torres 1964) the author was unable to provide chromosome counts for 1 of the 17 species of *Zinnia* and for 3 of the 7 species of *Sanvitalia*. The *Zinnia* species, *Z. purpusii*, had been known only from the state of Chiapas in Mexico. Because the collection site, "Hacienda Monserrate", was not, and still is not, located and because the species was known only from the type collection, it was surprisingly pleasant to find a population on the hillsides of gravelly soil along Mexican Highway 190, 1.6 miles east of the Oaxaca-Chiapas border (1739) and again 12 miles east of the same border (1743). From the first collection the chromosome number of $n = 12$ was determined. Meiosis was regular. Its chromosome number, although predictable, was of interest because its nearest phenetic ally, *Z. maritima*, is also $n = 12$. Yet several other near allies are $n = 11$. The count is significant also since chromosome numbers of all species are now known.

A few more collections of *Sanvitalia tenuis* had been made than of *Z. purpusii* yet its habitat too was relatively inaccessible. It apparently grows only on the eastern side of the Sierra Madre Occidental in western Chihuahua. Some 12 miles west of Miñaca (near Ciudad Guerrero and La Junta) in Chihuahua near the edge of oak-pine hills, I chanced upon a population of some 20-25 young plants just beginning to flower. Interestingly, all my collections were from the base of young oak trees on gentle slopes in gravelly soil. During the rainy season when *S. tenuis* is in flower the area is accessible by logging roads and only in high-center vehicles. An anomalous chromosome number pattern had already been established for *Sanvitalia* because the species are $n = 8$ or 16, except for *S. abertii* which is

¹Field work was supported by NSF grant GB-3842.

$n = 11$. It therefore became of especial interest to obtain the number of *S. tenuis* to see if it formed a link in a possible aneuploid series or if it was also $n = 8, 16$ or 11 . Its chromosome number is $n = 9$; meiosis appeared regular. Perhaps one of the two species as yet uncounted, Mexican *S. fruticosa* and South American *S. versicolor*, will fill the $n = 10$ gap.

Voucher specimens of both species will be housed at KANU with duplicates at MSC.

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LITERATURE CITED

- TORRES, A. M. 1962. Cytotaxonomy of cespitose zinnias. Amer. Jour. Bot. 49: 1033-1037.
———. 1963. Taxonomy of *Zinnia*. Brittonia. 15: 1-25.
———. 1964. Revision of *Sanvitalia* (COMPOSITAE-HELIAN-
THEAE). Brittonia. 16: 417-433.

TWO NEW NAIADS FROM ILLINOIS AND DISTRIBUTIONAL RECORDS OF THE NAIADACEAE¹

PAUL L. FORE² AND ROBERT H. MOHLENBROCK³

In the process of identifying Illinois species of *Naias* and in comparing fresh material with herbarium specimens, it was discovered that considerable misidentifications of specimens of this genus existed in Illinois. In order to present an accurate account of *Naias* in Illinois, and to up-date

¹An additional species *Najas marina* L. is reported from Illinois by Winterringer in this number of Rhodora (p. 221).

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distributional data of the species, the first author undertook this study of Naiadaceae of Illinois.

GEOGRAPHICAL CONSIDERATIONS

Clausen (1936), summarizing the geographical distributions of *Naias*, listed five species from the northern United States, two of which were known from Illinois. Likewise, Winterringer and Evers (1960) and Jones (1963) recorded only the occurrence of the same two species, *N. flexilis* (Willd.) Rostk. & Schmidt and *N. guadalupensis* (Spreng.) Magnus. The results of this investigation demonstrated that four species of *Naias* inhabit Illinois waters. Lawrence (1955) stated that a total of seven species were native to the continental United States out of a world-wide total of approximately forty species.

Two Illinois species have a general distribution in eastern North America from Newfoundland to Minnesota, south to Missouri and Virginia. Included here are *Naias flexilis* and *N. gracillima* (A. Br.) Magnus.

The remaining two species exhibit quite dissimilar ranges. *Naias guadalupensis* is known from Massachusetts to South Dakota, south to Texas and Florida, and Tropical America. *Naias minor* All., an introduced Eurasian species, is locally established in New York and West Virginia, according to Fernald (1950); this species is also reported by Muenscher (1944) to occur in Alabama and Tennessee. In addition to the above localities, *Naias minor* is now recorded from Illinois.

In Illinois, *Naias flexilis* is widely distributed, although not abundant, throughout the state; *N. guadalupensis* is found mainly in the western and southern parts of the state.

Naias gracillima, mostly distributed in southern Illinois, was recently rediscovered in three counties. The first recent specimen was collected in Williamson County in 1952 (although heretofore unreported), while the other two were found during 1961. Fernald (1945) reported that a specimen of *Naias gracillima* from Wabash County was listed in the Patterson Catalogue in 1876. Apparently, more than

76 years have elapsed since this species was originally collected in Illinois.

Possibly an adventive, *Naias minor* was discovered in June, 1963, in shallow alkaline waters of Lake Murphysboro in Jackson County. This naiad was growing in close association with *Naias flexilis*, *N. guadalupensis*, *Chara* spp., and *Jussiaea diffusa* in an aquatic community commonly dominated by *Potamogeton americanus*. *Naias minor*, which is known only from this station, represents a new record for Illinois.

Vascular plants such as *Naias* species are naturally occurring aquatics that were considered originally to have a valuable role in inland waters. Today, it is recognized that profuse submerged vegetation in ponds and lakes creates serious nuisance problems, particularly around aquatic recreational facilities, fish hatcheries, and drainage canals. Also, abundant clumps of *Naias* offer excessive escape cover to small fishes which may lead to over-population and stunting. For these reasons, dense stands of *Naias* are now often controlled chemically (Benson and Conner, 1956).

TAXONOMY OF NAIAS MINOR

Because of the lack of a detailed description of *Naias minor* in current manuals in the United States, an account of this species is presented here.

Naias minor All. Fl. Pedem. 2:221. 1875.

Slender to terminally compact annuals; stems slender, but slightly stouter than in *Naias gracillima*, moderately branched, the terminal nodes crowded, with lime-green internodes; leaves filiform, colored the same as the internodes, 2.0-3.5 cm long, 0.2-0.3 mm wide, the distal end spinescent, recurved, the sheath abruptly distended, truncate, finely toothed, each leaf-margin with 8-16 barely macroscopic spinules more than 0.5 mm long; style and 2 stigmas 1.0-1.4 mm long; epicarp purplish; achene falcate, slender, oblique, 2.6-3.6 mm long, $\frac{1}{4}$ as wide, marked with 10-18 regular vertical ribs of broad, rectangular reticulations.

Although both *Naias minor* and *N. gracillima* typically have long filiform leaves with suddenly abrupt bases and spiny margins, *N. minor* is unique with respect to the

regular, rung-like pattern on the achenes. These markings usually consist of 12 parallel longitudinal rows of wider than high, rectangular areolae.

In the field, *N. minor* is quite distinctive due to its branched, erect, bushy appearance, long narrow leaves, and pale, lime-green coloration which easily distinguishes this plant from its darker green, wider-leaved associates. Although growing to heights of 1-2 feet, *N. minor* is nevertheless a rather fragile plant with stiffish leaves and stems so brittle that they fragment readily at the nodes.

DISTRIBUTIONAL RECORDS OF ILLINOIS NAIADACEAE

County distributional data for the four species of *Naias* in Illinois are given below.

Naias flexilis (Willd.) Rostk. & Schmidt.

Specimens examined. — COLES: Fox Ridge State Park, Anderson 11386 (ISM). COOK: Cedar Lake, Roush 814 (MO). JACKSON: Lake Murphysboro, Weber s.n. (SIU). JERSEY: Lake of Grafton, Evers 38870 (ILLS). LAKE: Lake Marie, Winterringer 2671 (ISM). LEE: Amboy, Long 624 (ILL). MCHENRY: Crystal Lake, Pepoon 11425 (ILLS). MASON: Sand Lake near Havana, Richardson s.n. (ILLS). MENARD: Without locality, Hall 2 (ISM). PERRY: 4 miles W. of Du Quoin, Bell s.n. (SIU). RANDOLPH: Sinkhole N. of Chester, Evers 32786 (ILLS). ST. CLAIR: East St. Louis, Eggert 4258 (ILL). TAZE-WELL: Spring Lake, Chase 15843 (ILL). WABASH: Mt. Carmel, Schneck 91 (ILL). WILLIAMSON: Strip mine area near Cambria, Bell 4581 (SIU).

Naias guadalupensis (Spreng.) Magnus.

Specimens examined. — JACKSON: Along shore in shallow water of Lake Murphysboro, Fore & Stookey 105 (SIU). JEFFERSON: Mt. Vernon Reservoir, Fore & Stookey 301 (SIU). LAKE: Honey Lake, 4 miles N. of Barrington, Steyermark 63897 (ILL). MACOUPIN: Riniker Lake near Carlinville, Adams 11429 (ISM). PEORIA: Douglas Lake, without collector s.n. (ILLS). PERRY: Du Quoin City Reservoir, along the shore, Fore & Stookey 304 (SIU). POPE: Lake Glendale, 2 miles N. of Dixon Springs State Park, Fore & Andrews 302 (SIU). RANDOLPH: Coulterville Reservoir, Fore & Stookey 303 (SIU). ST. CLAIR: Farm N. of Little Rolling Mill, Eggert s.n. (MO). TAZEWELL: Spring Lake, Evers 39969 (ILLS). WILLIAMSON: Shallows of Crab Orchard Lake, Voight 441 (SIU).

Naias gracillima (A. Br.) Magnus.

Specimens examined. — FORD: Hoppler Pond, Hilterbran s.n.

(ILLS). JACKSON: Fountain Bluff Fish Farm near Gorham, *Lewis s.n.* (SIU). WILLIAMSON: Crab Orchard Lake, *Evers 34356* (ILLS). *Naias minor* All.

Specimens examined. — JACKSON. Shallow water of Lake Murphysboro, *Fore & Stookey 104* (SIU), *108* (SIU).

The authors express their appreciation to the curators of the following herbaria for the congenial cooperation and assistance shown them during this study: University of Illinois (ILL), Illinois Natural History Survey (ILLS), Illinois State Museum (ISM), Missouri Botanical Garden (MO), and Southern Illinois University (SIU).

LITERATURE CITED

- BENSON, N. G. and J. T. CONNER. 1956. Use of CMU to control *Naias*. *Prog. Fish-Cult.* 18:(2): 78-80.
- CLAUSEN, R. T. 1936. Studies in the genus *Najas* in the northern United States. *Rhodora* 38: 333-345.
- FERNALD, M. L. 1945. An incomplete flora of Illinois. *Rhodora* 47: 204-219.
- . 1950. *Gray's Manual of Botany*. 8th ed. The American Book Co., New York. 1632 pp.
- JONES, G. N. 1963. *Flora of Illinois*. 3rd ed. Amer. Midl. Nat. Monogr. 7: 1-401.
- LAWRENCE, G. H. M. 1955. *Taxonomy of vascular plants*. Macmillan Co., New York. 823 pp.
- MUENSCHER, W. C. 1944. *Aquatic plants of the United States*. Comstock Publishing Co., Ithaca, N. Y. 374 pp.
- WINTERRINGER, G. S. and R. A. EVERS. 1960. New records for Illinois vascular plants. *Ill. State Mus., Sci. Pap. Ser.* 11: 1-135.

AQUATIC VASCULAR PLANTS NEW FOR ILLINOIS

A project involving collection and identification of submersed and floating aquatic plants was undertaken jointly by the Illinois State Museum and the Illinois Department of Conservation in 1964-65. Conservation biologists of the Division of Fisheries collected aquatic plants from hundreds of lakes, ponds and rivers throughout the state. In October 1965, at the close of the project, 1175 collections had been made. A uniform data sheet was included with each collection to insure accurate locality records for all specimens. The plants, sent by mail in heavy envelopes to the Illinois State Museum for study and processing, were kept moist in thin plastic bags. Notes on the data sheet enclosed in each bag, or with each collection, were made in pencil to prevent smudges. These data sheets were dried, numbered and filed for reference. Alvin Lopinot of the Department of Conservation and the writer are preparing a field manual to assist biologists and students in the identification of submersed and floating aquatic plants of Illinois. This manual will be particularly intended to help conservation biologists in the study and control of aquatic plants wherever their abundance interferes with fishing.

One result of the project described above was the identification of two submersed aquatic vascular plants new for Illinois. These plants are *Najas marina* L. and *Ruppia maritima* L. Specimens have been filed in the Illinois State Museum Herbarium.

Collection data are as follows: LAKE CO., *Najas marina* L., 2½ mi. NE. of the village of Grayslake. Submersed in 3 feet of water in Druce Lake. The plants were abundant and established over a large area. The clear water of this glacial lake had a pH of 8.4. Oct. 5, 1964, G. S. Winterringer 22499 and 22503. In Wooster Lake, 1 mi. SW. of the village of Long Lake, Aug. 4, 1965, Ben L. Dolbeare 311 and 312. Originally collected in the Druce Lake locality, but not identified, by Gregg Tichacek, Sept. 9, 1964. VERMILION CO., *Ruppia maritima* L., 3 mi. NE. of Oakwood, Kickapoo State Park, in a strip mine pond called "Inland Sea". Abundant along the shallow margin of the pond and apparently established in water with a pH of 8.5. Sept. 18, 1964, G. S. Winterringer 22449 and 22451. Originally collected in the same locality, but not identified, by Rudy Steinauer,

Sept. 9, 1964. LAKE CO., *R. maritima* L., growing in Lake Zurich near Lake Zurich village. Sept. 28, 1965, Alvin Lopinot.

A third aquatic plant found recently in Illinois, *Najas minor* All., was reported in 1964 by Stookey, Fore and Mohlenbrock in *Castanea*: 29, pages 151 and 153. This naiad was first brought to the writer's attention in October 1963 by Alvin Lopinot who had collected it in Wayne and Greene counties. The museum herbarium now has specimens of *N. minor* from 31 additional counties in the southern three quarters of Illinois, extending southward from Henderson and Iroquois counties.

Procedure of handling specimens in the laboratory may be of interest. Each collection, with its numbered data sheet, was placed in plastic ice cream containers or floated in the sink during examination. Identification was made easier by working with fresh and mature specimens. In preparing material for mounting we used a technique of floating delicate species, e.g., *Zannichellia palustris* L., on letter size bond paper. The film of water on the paper and specimen permitted final arrangements of the material by moving it with a small brush. The sheet of paper with the specimen was lifted carefully to remove most of the water, or the sink was slowly drained before lifting the sheet. The bond paper bearing its specimen was numbered from the corresponding data sheet, placed on blotting paper or drying sheets and finally inserted in a folder of newsprint. Thus, a press of wet specimens was ready for the dryer. When specimens on bond paper were thoroughly dry they were pasted on standard herbarium sheets to avoid additional handling of the dried specimen. Drops of Duco cement or very narrow strips of gummed cloth were used to secure loose parts wherever needed. The cement also permitted fastening loose achenes of *Potamogeton* and fruiting parts of various other species. We have added approximately 2000 sheets of aquatics to the museum herbarium as a final result of the work described above.

GLEN S. WINTERRINGER

ILLINOIS STATE MUSEUM, SPRINGFIELD

STUDIES IN THE FLORA OF BOLIVIA — IV.

ROBERT C. FOSTER

Continued from Vol. 68, No. 773

11. *Briza* L.

See Parodi in *Revist. Fac. Agron. Vet. Buenos Aires*, 3: 113-158 (1920).

Perennials, the erect culms 2-8 dm. high. Leaves chiefly basal, much shorter than the inflorescence, glabrous, often scabridulous, 1-2 mm. wide. Inflorescence a loose to dense racemose panicle. Spikelets oblong-elliptic, longer than broad, but the shorter ones verging on the suborbicular, usually many-flowered, the crowded florets erect to nearly horizontal, the naked rachilla disarticulating above the glumes; glumes subequal, the margins scarious, awnless; lemmas awnless, more or less wing-margined and closely imbricate.

Lemmas, and often the glumes, tuberculate-scabrid; lemmas about 2 mm. long; palea glabrous. 1. *B. Mandoniana*.

Lemmas and glumes not tuberculate-scabrid; lemmas to 5 mm. long; palea covered with gland-tipped hairs. 2. *B. paleapilifera*.

1. *Briza Mandoniana* (Griseb.) Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 70 (1921). *B. Mandoniana* var. *tuberculata* Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 71 (1921). *B. Mandoniana* var. *Herzogiana* Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 71 (1921). *B. Mandoniana* var. *vallegrandensis* Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 71 (1921). Spikelets 3-5 mm. long, oblong-elliptic, with up to 8 florets. Glumes 2-2.5 mm. long, broadly ovate, often scabrid to tuberculate, the scabrid apex somewhat erose, the basal margins shortly ciliate. Palea shorter than the lemma, bicarinate, the keels ciliolate. LA PAZ: LARECAJA: vic. Sorata; Lacatia and Lancha de Cochipata, 3200-3600 m., *Mandon* 1356 (GH; type-number); Cerro del Iminapi, 2650 m., *Mandon* 1355 (GH); Sorata, 4300 m., *Rusby* 238 (GH); NOR YUNGAS: Pongo, 3640 m., *Hitchcock* 22773 (GH).

2. *B. paleapilifera* Parodi in *Revist. Fac. Agron. Vet. Buenos Aires*, 3: 124, fig. 2, no. 5 (1920). *B. stricta* of the Catalogue.* Plants to

*The Catalogue refers to A Catalogue of Ferns and Flowering Plants of Bolivia, in *Contrib. Gray Herb.* no 184 (1958).

6 dm. high. Leaf-blades to 2 mm. wide, glabrous to slightly scabridulous above and beneath. Panicle 7-12 cm. long, the rachis, branches and pedicels scabrid, at least in part. Spikelets oblong-elliptic, to 7 mm. long, to 8-12-flowered. Glumes to 4.5 mm. long, broadly ovate, 5-7-nerved, subacute to obtuse. Lemmas to 3-5 mm. long, subquadrate, the apex coarsely 3-lobed, the lateral lobes broad, obtusely rounded,

the central lobe triangular, acute, keel prominent, thickened, the lateral nerves with a basal vertical line of short, thick, unicellular hairs. Palea oval, subacute to obtuse, about 2 mm. long, the dorsal surface with numerous short gland-tipped hairs. bicarinate, the keels narrowly winged, short-ciliate. COCHABAMBA: CERCADO: Cochabamba, Holway 383 (US).

The Holway collection is the basis on which Hitchcock ascribed *Briza stricta* to Bolivia in his treatment of the Andean grasses. No Bolivian material of *B. Stricta* has been seen.

Briza spicigera (Presl) Steud. Nomencl. (ed. 2) 1: 225 (1840). No material has been seen from Bolivia, but it has been ascribed to that country by Pilger in Notizbl. 11: 780 (1933). The basis for this consists of two Troll collections, no. 632 from CHUQUISACA: TOMINA: Alto de Escalón, and no. 834, from the Alto de Cuchilla, which I have been unable to locate. If the species should be found, it can be distinguished by the laterally compressed lemmas which are finely and densely papillate, emarginate at the apex, with the markedly thickened and prominent keel excurrent as a short thick mucro or cusp. The species is apparently identical with *Briza uniola* (Nees) Nees ex Steud. Syn. Pl. Glum. 1: 283 (1854). If this is the case, the latter name should be applied to it, for its basionym, *Eragrostis uniola* Nees, was published a year earlier than the basionym of *Briza spicigera*, *Chascolytrum spicigerum* Presl. It has been illustrated by Parodi, l. c., under the name *Briza uniola*.

12. *Eragrostis* Beauv.

Annuals or perennials, from very low mat-forming plants to erect plants up to 2 m. high. Leaves flat or involute, seldom equaling or exceeding the inflorescence at maturity. Inflorescence a terminal racemose panicle, from dense, with erect compact branching, to very open, with freely and widely spreading branches, the spikelets 2-36-flowered disarticulating above the awnless glumes, the rachilla usually glabrous. Lemmas awnless, occasionally the lowermost sterile, but sterile and reduced florets usually borne at the tip, the paleas usually persistent on the rachilla after the fall of the lemmas and caryopses.

- a. Palea long-ciliate, the conspicuous hairs up to 1 mm. long. 1. *E. ciliaris*.
- a. Palea short-ciliate at most, the hairs inconspicuous.
 - b. Largest spikelets at least 1 cm. long.
 - c. Axils of inflorescence, at least the lowermost, pilose.
 - d. Glumes equal or subequal.
 - e. Glumes gland-dotted on keel, especially near the apex. 3. *E. cilianensis*.
 - e. Glumes not gland-dotted on keel. 12. *E. bahiensis*.

- d. Glumes distinctly unequal. 5. *E. maypurensis*.
- c. Axils of inflorescence glabrous. 2. *E. hypnoides*.
- b. Largest spikelets less, usually much less, than 1 cm. long.
- f. Axils of inflorescence glabrous.
- g. Plants to 2 m. high, the leaf-blades to 6 mm. wide, scabridulous on both surfaces. 4. *E. glomerata*.
- g. Plants less than 1 m. high, the leaf-blades 2-3 mm. wide.
- h. Glumes equal or subequal.
- i. Spikelets 1 mm. wide, 2-6-flowered. 7. *E. nigricans*.
- i. Spikelets 2 mm. wide, with 7 or more florets. 9. *E. mexicana*.
- h. Glumes definitely unequal. 13. *E. expansa*.
- f. Axils of inflorescence, at least the lowermost, pilose to some extent.
- j. Lemmas 1.5 mm. or less in length.
- k. Largest spikelets 7 mm. long, with up to 12 florets. 6. *E. articulata*.
- k. Largest spikelets 5 mm. long, with up to 9 florets. 11. *E. montufari*.
- j. Lemmas 2 mm. or more in length.
- l. Rachilla puberulent. 10. *E. lurida*.
- l. Rachilla glabrous, or with 1-2 short hairs at most below a floret.
- m. Leaf-blades glabrous beneath, scabridulous above. 8. *E. pilosa*.
- m. Leaf-blades at least sparsely pilose above.
- n. Panicle to 20 cm. long, leaf-blades sparsely pilose. 14. *E. lugens*.
- n. Panicle to 3 dm. long, leaf-blades and sheaths densely pilose. 15. *E. polytricha*.

1. *Eragrostis ciliaris* (L.) Link, Hort. Berol. 1: 192 (1827). Annual, to 4 dm. high. Leaf-sheaths long-pilose at apex, blades flat, to 4 mm. wide, sparsely long-pilose at base, scabridulous above. Panicle dense, interrupted below and often above, the rachis glabrous, branches and pedicels scabridulous. Spikelets about 3 mm. long, with up to 8 florets, the rachilla glabrous. First glume about 1 mm. long, 1-nerved, the keel scabridulous; second glume about 1.5 mm. long, 1-nerved, the keel scabridulous. Lowest lemmas 1.5 mm. long, 3-nerved, the lateral nerves submarginal, minutely scabridulous; width (folded) 0.5 mm. Palea shorter than lemma, the 2 keels long-ciliate, the hairs up to 1 mm. long. SANTA CRUZ: SARA: Dolores, Steinbach 1831 (GH).

2. *E. hypnoides* (Lam.) BSP. Prelim. Cat. N. Y. 69 (1888). Annual, often forming prostrate mats, culms to 1 dm. high. Leaf-sheaths ciliate and sparsely pilose at apex, the short blades to 2 cm. long, flat or somewhat involute, sparsely pilose above, glabrous beneath. Rachis and pedicels glabrous, or the pedicels with a few short hairs at

base or apex. Largest spikelets to about 1.5 cm. long, commonly about 1 cm. long, with up to 25 florets, the rachilla glabrous. First glume 1.5 mm. long, 1-nerved, the keel scabridulous; second glume to 2.5 mm. long, 1-nerved, the keel scabridulous. Lowest lemmas to 2.5 mm. long, 3-nerved, the keel scabridulous, width (folded) about 0.6 mm. Palea about 1 mm. long, the 2 keels distinctly ciliate. BENI: CERCADO MOJOS: Trinidad, 200 m., *Cárdenas* 3536 (GH). LA PAZ: LA-RECAJA: Guanai, 650 m., *Rusby* 230 (GH). SANTA CRUZ: SARA: Palometilla, *Steinbach* 2914 (GH).

3. *E. cilianensis* (All.) ex Vign. Lut. in *Malpighia*, 18: 386 (1904). Annual, to 5 dm. high, but usually shorter, the leaf-sheaths ciliate, pilose around the apex, the blades flat, to 4 mm. wide, scabrid-ciliate, otherwise glabrous. Panicle to 1 dm. long, fairly compact, the rachis glabrous, the pedicels usually scabridulous. Spikelets to 1 cm. long, with up to 20 florets, the rachilla glabrous. Glumes equal, to 1.5 mm. long, 1-nerved, the nerve with 1-2 glandular dots and scabridulous at the apex. Lowest lemmas about 2 mm. long, 3-nerved, the keel gland-dotted and scabridulous at the apex, scabridulous between lateral nerves and margin, width (folded) 1 mm. Palea about 1.5 mm. long, the 2 keels ciliate. Bolivian Plateau: *Bang* 1078 (GH). COCHABAMBA: CERCADO: Cochabamba, 2700 m., *Eyerdam* 24882 (GH). SANTA CRUZ: SARA: Buenavista, *Steinbach* 1944 (GH).

4. *E. glomerata* (Walt.) L. H. Dewey in *Contrib. U. S. Nat. Herb.* 2: 543 (1894). Annual, to 2 m. high. Leaf-sheaths glabrous, the long-attenuate flat blades to 30 cm. long and 6 mm. wide, scabridulous on both surfaces. Panicle to 4 dm. long, narrow, the branches erect, appressed, rachis and pedicels scabridulous. Spikelets about 3 mm. long, or less, with up to 7 florets, the rachilla glabrous. Glumes equal, 1 mm. long or less, 1-nerved, the keel sparsely scabridulous. Lowest lemmas about 1 mm. long, 3-nerved, the keel scabridulous, width (folded) less than 0.5 mm. Palea about 0.5 mm. long, the keels short-ciliate. LA PAZ: SUR YUNGAS: Covendo, *White* (M. E.)* 915, 1000 (Hitchcock).

5. *E. maypurensis* (HBK.) Steud. *Syn. Pl. Glum.* 1: 276 (1854). Annual, to 3 dm. high, leaves mostly basal, short, the sheaths pilose, the narrow blades pilose, at least when young. Panicle to 15 cm. long, the rachis and pedicels glabrous to pilose. Spikelets very variable, the largest 1-2.5 cm. long, with up to 36 florets, the rachilla glabrous. First glume to 2.5 mm. long, 1-nerved; second glume to 3 mm. long, 3-nerved, broader than the first. Lowest lemmas to 3 mm. long, long-acute or acuminate, 3-nerved, the keel scabridulous, width (folded) 1 mm. Palea nearly 2 mm. long, the keels short-ciliate.

*The initials M. E. refer to collections made on the Mulford Biological Exploration. The number-series of these collections duplicates other number-series of the same collectors.

SANTA CRUZ: SARA: Dolores, near Buenavista, 500 m., *Steinbach* 6138 (GH).

6. *E. articulata* Nees, *Agrost. Bras.* 502 (1829). Annual, to 4 dm. high. Leaf-sheaths sparsely pilose, the flat, short blades 2-4 mm. wide, densely papillose-hispid, especially beneath. Panicle usually about half the total length of culms, open, the branches distant, the rachis glabrous, branches and pedicels sparsely scabridulous. Largest spikelets to 7 mm. long, 1 mm. wide, with up to 12 florets, the rachilla glabrous. First glume 1 mm. long, 1-nerved, the keel scabridulous; second glume about 1.5 mm. long, obscurely 3-nerved, the keel scabridulous. Lowest lemmas about 1.5 mm. long, 3-nerved, width (folded) 0.5 mm. Palea shorter than lemma, bicarinate, the keels glabrous, the margins finely ciliolate. COCHABAMBA: MIZQUE: near Vilavila, 2700 m., *Eyerdam* 24965 (GH). SANTA CRUZ: SARA: Buenavista 500 m., *Steinbach* 5182, 6142, 6991 (all GH).

Eragrostis articulata var. *glabrescens* Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 69 (1921) was distinguished as having glabrous leaves. According to Hitchcock (*Contrib. U. S. Nat. Herb.* 24: 338), the "spikelet is more slender and has more florets than those of *E. articulata*, and appears to belong to a distinct species."

7. *E. nigricans* (HBK.) Steud. *Nomencl.* (ed. 2) 1: 563 (1840). *E. subatra* Jedw. in *Mez, Bot. Arch.* 5: 202 (1924). Annual, the decumbent culms to 5 dm. long. Leaf-sheaths glabrous but pilose at the base of the blade, the blades flat, to 3 mm. wide. Panicle dark, to 2 dm. long, open, the branches spreading, rachis, branches and pedicels glabrous. Spikelets 4-6 mm. long, with 2-6 florets, the rachilla glabrous. Glumes equal, about 2 mm. long, the second broader than the first, the keels scabridulous. Lowest lemmas 2.5 mm. long, obscurely nerved, the keel slightly scabridulous, width (folded) 0.7 mm. Palea 2 mm. long, keels ciliolate. LA PAZ: MURILLO: La Paz, 3800 m., *Buchtien* 42 (GH), 3965 (GH), 3300 m., *Bang* 21 (GH), 80 (GH; type-number of *E. subatra*), *Pennell* 14216 (GH); Obrajes, 3300 m., *Buchtien* 562 (GH). POTOSÍ: SUR CHICHAS: Oploca, *Hitchcock* 22928 (GH).

8. *E. pilosa* (L.) Beauv. *Ess. Agrost.* 162 (1812). Annual, to 3 dm. high. Leaf-sheaths long-ciliate, pilose at apex, the flat blades about 2 mm. wide, scabridulous above, glabrous beneath. Panicle open at maturity, to 20 cm. long, rachis glabrous, the branches and pedicels often scabridulous. Spikelets to 5 mm. long, about 1 mm. wide, with up to 8 florets, the rachilla glabrous. First glume about 0.75 mm. long, 1-nerved, the nerve faintly scabridulous; second glume slightly over 1 mm., 1-nerved. Lowest lemmas about 2 mm. long, obscurely 3-nerved, the keel scabridulous, width (folded) about 0.5 mm. Palea somewhat shorter than the lemma, bicarinate. LA PAZ: LARECAJA: vic. Sorata; near Munaypata, 2650-2900 m., *Mandon* 1329 (GH); MURILLO: Obrajes, 3400 m., *Buchtien* 820 (GH). COCHABAMBA: CERCADO: Cocha-

bamba, 2560 m., *Cárdenas* 2471 (GH). SANTA CRUZ: SARA: El Limón, *Steinbach* 1786 (GH). TARIJA: ARCE: Padcaya, 2100 m., *Fiebrig* 2528 (GH).

9. *E. mexicana* (Lag.) Link, Hort. Berol. 1: 190 (1827). Annual, to 4 dm. high. Leaf-sheaths ciliate, pilose at the apex, the blades flat, glabrous, 2-3 mm. wide. Panicle fairly open, the branches distant, to 30 cm. long, rachis glabrous, the branches and pedicels scabridulous. Spikelets to 7-8 mm. long, with 7 or more florets, the rachilla glabrous. Glumes equal or subequal, to 2.5 mm. long, the first 1-nerved, the keel scabridulous, the second obscurely 3-nerved, the keel scabridulous. Lowest lemmas to 2.5 mm. long, the keel scabridulous, apex obtuse to subacute, width (folded) 0.7 mm. Palea to 2 mm. long, the keels ciliate. LA PAZ: SUR YUNGAS: Sirupaya, *Buchtien* 428 in part (*Hitchcock*).

10. *E. lurida* Presl, Rel. Haenk. 1: 276 (1830). Perennial, very variable in height, up to 1 m. tall. Leaf-sheaths ciliate and pilose at apex, the flat blades to 2 mm. wide, sometimes very sparsely pilose. Panicle to 3 dm. long, the primary branches distant, the rachis glabrous, pedicels finely scabridulous. Spikelets to 5 mm. long, 7-8-flowered, the rachilla puberulent. First glume 1.5 mm. long, keel scabridulous, the second glume 2 mm. long, the keel scabridulous. Lowest lemmas to 2.5 mm. long, 3-nerved, the scabridulous keel very prominent, emarginate at the obtuse apex, width (folded) 0.8 mm. Palea as long as lemma, the keels ciliate. LA PAZ: LARECAJA: vic. Sorata; Ullontiji, 2900 m., *Mandon* 1332 (GH; type-number of *E. bahiensis* var. *boliviensis*); MURILLO: near La Paz, 4000 m., *Rusby* 49 (GH), 3800 m., *Buchtien* (GH).

11. *E. montufari* (HBK.) Steud. Nomencl. (ed. 2) 1: 563 (1840). *E. Buchtienii* Hack. in Fedde, Rep. Sp. Nov. 6: 157 (1908). *E. boliviensis* Jedw. in Mez, Bot. Arch. 5: 205 (1924). Perennial, to 6 dm. high. Leaf-sheaths pilose, at least at apex, the flat blades to 4 mm. wide, pilose above and beneath. Panicle 10-30 cm. long, the primary branches distant, rachis, branches and pedicels scabridulous. Spikelets to 5 mm. long, up to 9 florets, about 1 mm. wide, the rachilla glabrous except for an occasional short hair at the apex of a section. Glumes about equal, 1 mm. long, or a little more, 1-nerved, the keels scabridulous. Lowest lemmas 1.5 mm. long, rounded, obscurely nerved, the keel scabridulous at apex, width (folded) 0.5 mm. Palea about 1 mm. long, bicarinate, the keels glabrous, the margins ciliolate. LA PAZ: LARECAJA: vic. Sorata; Cerro del Iminapi, 2650 m., *Mandon* 1330 (GH; type-number of *E. boliviensis*); MURILLO: La Paz, *Bang* 201 (GH); Cotaña, 2450 m., *Buchtien* (GH). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22798 (GH).

12. *E. bahiensis* Schrad. ex Schult. Mant. 2: 318 (1824). Perennial, to 8 dm. high. Leaf-sheaths pilose at apex, the blades 2 mm. wide, flat or somewhat involute, sparsely pilose. Inflorescence a lax to

compressed panicle, to 15 cm. long, the branches distant, the rachis glabrous, branches and pedicels scabridulous. Largest spikelets over 1 cm. long, 3-4 mm. wide, with up to 15 florets, the rachilla glabrous. Glumes subequal, about 2 mm. long, obscurely nerved, the keels scabridulous at apex. Lowest lemmas to 3 mm. long, 3-nerved, the keel very prominent and scabridulous at apex, width (folded) 1 mm. Palea 2 mm. long, bicarinate, the keels glabrous, the margins ciliate. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22681 (GH). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5184 (GH), 6881 (GH); Río Perdix, 400 m., *Steinbach* 6889 (GH).

13. *E. expansa* Link, Hort. Berol. 1: 190 (1827). Perennial, to 8 dm. high. Leaf-sheaths pilose at apex, the blades flat to involute, 2 mm. wide, scabridulous above. Panicle open, to 15 cm. long, primary branches distant, rachis glabrous, branches and pedicels scabridulous. Largest spikelets about 5 mm. long (in some non-Bolivian material to 1.5 cm.), 1 mm. wide, with up to 11 florets, the rachilla usually glabrous but occasionally with a few hairs. First glume 1 mm., the keel scabridulous; second glume 1.5 mm., the keel scabridulous. Lowest lemmas 2 mm. long, 3-nerved, the keel scabridulous at the apex, width (folded) 0.5 mm. Palea 1.5 mm. long, keels glabrous, margins ciliate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6853 (GH); Río Perdix, 400 m., *Steinbach* 6899 (GH).

14. *E. lugens* Nees, Agrost. Bras. 505 (1829). *E. soratensis* Jedw. in Mez, Bot. Arch. 5: 213 (1924). Perennial, to 5 dm. high. Leaf-sheaths pilose to sparsely pilose and ciliate, to more or less glabrate, the blades flat to involute, usually sparsely pilose. Panicle open, to 20 cm. long, the primary branches distant, the rachis glabrous, branches and pedicels somewhat scabridulous. Spikelets 5 mm. long, or less, about 1 mm. wide, 5-6-flowered, the rachilla glabrous. First glume 1 mm., the second 1.5 mm. long, the keels scabridulous. Lowest lemmas 2 mm. long, obscurely nerved, the keel and apex slightly scabridulous, width (folded) 0.8 mm. Palea somewhat shorter than the lemma, keels glabrous, margins ciliate. Yungas: *Bang* 307 (GH). LA PAZ: LARECAJA: Sorata, 3300 m., *Rusby* 239 (GH); Cerro del Iminapi, 2650 m., *Mandon* 1283 (GH); Sicasica, 2650-2900 m., *Mandon* 1331 (GH; type-number of *E. soratensis*). COCHABAMBA: MIZQUE: near Vilavila, 2500 m., *Eyerdam* 25021 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7091 bis (GH).

15. *E. polytricha* Nees, Agrost. Bras. 507 (1829). Perennial, up to 1 m. high. Leaf-sheaths densely long-pilose, the blades flat to involute, densely long-pilose. Panicle to 3 dm. long, very open, the rachis, branches and pedicels scabridulous. Spikelets 5 mm. or less, 3-5-flowered, 1.3 mm. wide, the rachilla glabrous with occasionally a few short hairs below the florets. First glume 1 mm. long, the second, 1.5 mm., keels strongly scabridulous. Lowest lemmas to 2 mm. long, keel scabridulous, width (folded) 0.5 mm. Palea 1.5-2 mm.

long, margins ciliolate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6980 (GH).

13. *Distichlis* Raf.

Perennial, plants dioecious, rhizomatous, culms erect, from 3 to 30 cm. high. Leaves glabrous or glaucous or softly puberulent or even pilose, particularly on the sheaths, obviously distichous, shorter to longer than the inflorescence, blades usually folded or involute, 1 mm. wide or less. Inflorescence a terminal racemose panicle, the panicle somewhat condensed. Spikelets few- to many-flowered, the staminate spikelets of a rather softer texture than the pistillate, glumes present, the naked rachilla disarticulating above the glumes, the lemmas rather obscurely nerved.

- a. Dwarf plants, less than 10 cm. high.
 - b. Leaf-sheaths pilose, at least in part, blades usually glabrous; panicles of 1-3 spikelets, the panicle about 1 cm. long. 1. *D. humilis*.
 - b. Leaf-sheaths glabrous or very sparsely pilose at summit, blades glabrous or sparsely pilose when young; panicles longer than 1 cm., with more numerous spikelets. .. 2a. *D. spicata* var. *andina*.
- a. Taller plants, up to 30 cm. high, panicles with numerous spikelets. 2. *D. spicata*.

1. *Distichlis humilis* Phil. in Anal. Mus. Nac. Chile, 8: 86 (1891). Leaf-sheaths closely imbricate, the blades spreading, to 1 cm. long, or less. Spikelets barely or not at all exserted from leaves, to 7 mm. long, 3-6-flowered. Glumes equal to subequal, the second to 4 mm. long. Lemmas to 4.5 mm. long. Palea shorter than the lemma, bicarinate, the keels narrowly winged and minutely ciliolate. POTOSÍ: SUR CHICHAS: Atocha, *Hitchcock* 22876 (GH).

2. *D. spicata* (L.) Greene in Bull. Calif. Acad. Sci. 2: 415 (1887). Plants generally much taller than the preceding, the leaf-blades much longer and often exceeding the inflorescence, the sheaths not closely imbricate. Panicle exserted from the leaves, to 7 cm. long. Spikelets to 1.8 cm. long and up to 20-flowered. Glumes unequal, the first to 1.5 mm. long, the second to 2.5 mm. Lemmas about 3.5 mm. long. Palea as long as the lemma, bicarinate. LA PAZ: MURILLO: La Paz, 3300 m., *Bang* 108 (GH). COCHABAMBA: CERCADO: Valle de Cochabamba, 2600 m., *Steinbach* 8745 (GH). POTOSÍ: SUR CHICHAS: Oploca, *Hitchcock* 22883 (GH), 22884 (GH).

2a *D. spicata* var. *andina* Beetle in Revist. Argent. Agron. 22: 93 (1955). Differs in smaller size, short leaf-blades (to 2 cm.), shorter panicles, smaller and fewer-flowered spikelets. LA PAZ: MURILLO: San Jorge, 3550 m., *Buchtien* 8537 (GH).

Distichlis spicata gamma *marginata* (Phil.) O. Ktze. Rev. Gen. 3 (2): 350 (1898) was recorded for Bolivia by Kuntze,

on the basis of a collection made by him. In view of some of Kuntze's notorious misdeterminations, I hesitate to accept it on such a basis alone.

14. *Arundo* L.

Arundo Donax L. Sp. Pl. 81 (1753). Rhizomatous perennial, the culms to 6 m. high, occasionally branched. Leaves very long, 3-7 cm. wide, the margins scabrid. Inflorescence a large, dense, terminal, drooping, racemose panicle to 6 dm. long. Spikelets to 1.2 cm. long, 3-4-flowered, the florets perfect, successively smaller upwards, the naked rachilla disarticulating above the glumes; glumes somewhat unequal, the first about 1 cm. long, the second 1.4 cm., as long as the spikelet; lemmas about 1 cm. long, hyaline, strongly 3-nerved, apex 2-toothed with a central awn to 3 mm. long, the rounded back and sides densely long-villous; palea to 5 mm. long, obtuse, with 2 prominent marginal nerves, the margins densely ciliate. LA PAZ: NOR YUNGAS: Coroico, *Hitchcock* 22724 (US).

15. *Phragmites* Trin.

Phragmites communis Trin. Fund. Agrost. 134 (1820). Rhizomatous stoloniferous perennial, with culms to 4 m. high. Leaves long, to 5 cm. wide. Inflorescence a terminal, plumose, racemose, tawny panicle, the branches ascending, to 4 dm. long. Spikelets about 1.5 cm. long, 2-7-flowered, the long-villous rachilla disarticulating above the glumes; glumes unequal, the first nearly 5 mm. long, 3-nerved, the second, 6.5 mm. long, 5-nerved, much shorter than the spikelet; lowest floret staminate or sterile, the awnless lemma about 1.2 cm. long; upper florets perfect, the glabrous lemmas long-attenuate into a 6 mm. pseudo-awn; palea about 5 mm. long, acute, slightly bidentate, the margins ciliate. CHUQUISACA: SUR CINTI: Camataquí, about 2500 m., *Fiebrig* 2954 (US).

16. *Cortaderia* Stapf

Large perennials, to 1.5 m. high. Leaves nearly as long as the culms, the blades to 1.5 cm. wide, the margins and midrib scabrous beneath, old leaf-bases coiled at base of plant. Inflorescence a large, terminal, plumose, racemose panicle. Spikelets unisexual or perfect, if unisexual the plants dioecious, 1-several-flowered, the glumes often as long as the spikelet, hyaline, the villous rachilla disarticulating above the glumes; lemmas hyaline, tapering to a long awnlike prolongation or bearing 2 such structures flanking a true awn.

Plants dioecious; lemma not bidentate, with 1 long pseudo-awn. 1. *C. rudijscula*.
Plants not dioecious; lemma bidentate, with 2 long pseudo-awns flanking a long true awn. 2. *C. bifida*.

1. *Cortaderia rudiusscula* Stapf in Gard. Chron. (ser. 3) 22: 396 (1897). Panicle yellowish or purplish, to 6 dm. long, the branches dense and drooping. Staminate spikelets about 1 cm. long, 2-3-flowered (occasionally 1-flowered). Glumes 6-8 mm. long, 1-nerved. Lemmas 5 mm. long, with a 6 mm. pseudo-awn, villous on the back and sides. Palea as long as the lemma. Pistillate spikelets about 1.2 cm. long, about 4-flowered. Glumes nearly equal, 8 and 9 mm. long, 1-nerved. Lemmas about 4 mm. long, the pseudo-awn about 6 mm. long, densely long-villous on back and sides. Palea as long as lemma, bicarinate, the keels ciliolate. LA PAZ: MURILLO: La Paz, 3750 m., *Buchtien* 507 (GH), *Shepard* 167 (GH), 3300 m., *Bang* 26 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22701 (GH). COCHABAMBA: CHAPARE: Incachaca, 2250 m., *Steinbach* 9493 (GH). POTOSÍ: CHICHAS: Quechisla, *Cárdenas* 98 (GH). SANTA CRUZ: SARA: quebrada del Río Blanco, Cerro Hosana, 1300 m., *Steinbach* 3372 (GH). TARIJA: CERCADO: Tarija, 2850 m., *Fiebrig* 2656 (GH); Paicho, 2900 m., *Fiebrig* 3043 (GH).

2. *C. bifida* Pilger in Engler, Bot. Jahrb. 37: 374 (1906). *C. bifida* var. *grandiflora* Henrard in Meded. Rijks Herb. Leiden, no. 40: 67 (1921). Panicle yellowish to purple, about 2 dm. long, laxer than in *C. rudiusscula*. Spikelets of perfect florets, 3-4 in number, about 8-10 mm. long (excluding the awns). Glumes unequal, 7 and 9 mm. long, hyaline, 1-nerved, long-acute. Lemmas about 5 mm. long, the 2 teeth prolonged into pseudo-awns 6-18 mm. long, true awn 1.1-2.2 cm. long, lemma long-villous, primarily near the base. LA PAZ: MURILLO: Unduavi, 3200 m., *Buchtien* 2575 (GH). SANTA CRUZ: SARA: Cerro La Negra, 1800 m., *Steinbach* 8171 (GH).

17. *Gynerium* Humb. & Bonpl.

Gynerium sagittatum (Aubl.) Beauv. Ess. Agrost. 138 (1812). Large dioecious perennial, to 10 m. high. Leaf-blades to 2 m. long and 4-6 cm. wide, the margins scabrous-serrulate. Inflorescence a terminal, dense, plumose, racemose panicle to 1 m. long, the branches drooping. Spikelets unisexual, usually several-flowered, the naked rachilla disarticulating above the glumes, glumes and lemmas quite different in staminate and pistillate spikelets. Staminate spikelets: 1-3-flowered, 4 mm. long; glumes somewhat unequal, 2.5 and 3 mm. long, hyaline, acute but not produced; lemmas to 3.5 mm. long, glabrous, acute but not produced. Pistillate spikelets: 2-3-flowered, 6 mm. long; glumes very unequal, the first 3-4 mm. long, acute, the second 9-10 mm. long, long-attenuate and produced into a pseudo-awn much exceeding the spikelet; lemmas to 5 mm. long, long-attenuate into a pseudo-awn about 4-5 mm. long, densely long-villous; stigmas black-purple. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22683 (Hitchcock); SUR YUNGAS: Covendo, *White* (M. E.) 901 (US), 984 (US).

18. *Melica* L.

See Papp in Fedde, Rep. Sp. Nov. 25: 97-160 (1928).

Straggling perennials, culms up to 1 m. high, usually shorter. Leaf-sheaths scabrous, the blades flat or involute, occasionally equaling or even exceeding the inflorescence. Inflorescence a rather narrow, terminal, racemose panicle, the branches distant, spreading. Spikelets 1-4-flowered, the lowest 1-2 perfect, the upper 2-3 sterile and aggregated into a clavate mass, the rachilla glabrous or minutely puberulent, disarticulating above the glumes, the spikelet falling as a unit; lemmas densely puberulent or tuberculate-scabridulous.

a. Lowest lemma with large thick hairs on lateral and submarginal nerves. 1. *M. violacea*.

a. Lowest lemma without large thick hairs.

b. Spikelets to 1 cm. long, perfect florets 1-2; leaf-blades flat, 2-6 mm. wide. 2. *M. scabra*.

b. Spikelets to 7 mm. long, 1 perfect floret; leaf-blades narrow, involute. 3. *M. adhaerens*.

1. *Melica violacea* Cav. Ic. 5: 47, t. 472 (1799). Spikelet about 7 mm. long, with 1 perfect floret. First glume suborbicular, about 7 mm. long, prominently nerved on the lower portion, the hyaline margins broad; second glume much narrower, about as long, densely scabridulous-puberulent. Fertile lemmas 5-6 mm. long, many-nerved, densely puberulent. Palea as long as lemma, bicarinate, the keels ciliate, the inter-carinal area scabridulous-puberulent. SANTA CRUZ: VALLEGRANDE: Comarapa, 3000 m., *Steinbach* 8461 (GH).

2. *M. scabra* HBK. Nov. Gen. & Spec. 1: 164 (1816). *M. scabra* var. *glabra* Papp in Fedde, Rep. Sp. Nov. 25: 145 (1928). Spikelets to 6-10 mm. long, with 1-2 perfect florets. Glumes unequal, more or less hyaline, especially on the margin, 1-nerved, the first 8 mm. long, the second to 10 mm. Fertile lemmas to 8 mm. long, the upper portion hyaline, the lower part many-nerved, the nerves and intercostal areas densely tuberculate-scabridulous. Palea to 5 mm. long, bicarinate, the keels ciliate, the back usually puberulent. LA PAZ: LARECAJA: Sorata, *Mandon* 1343 (US).

3. *M. adhaerens* Hack. in Fedde, Rep. Sp. Nov. 6: 158 (1908). *M. adhaerens* var. *tenuis* (Papp) Papp in Notizbl. 10: 412 (1928). *M. Mandonii* Papp in Notizbl. 10: 356 (1928). Spikelet about 7 mm. long, with 1 perfect floret. First glume 7 mm. long, broadest above the middle, abruptly short-acute, 1-nerved; second glume as long, much narrower, the nerves obscure, lower half puberulent-scabrid. Fertile lemma about 6 mm. long, apex hyaline, lower half many-nerved, densely tuberculate-scabrid. Palea about 4 mm. long, bicarinate, the keels ciliate, the back densely puberulent. LA PAZ: MURILLO: Poto-poto, Río Chuquiaguillo, 3700 m., *Mandon* 1357 (GH; type-number of *M. Mandonii*); La Paz, 3300 m., *Bang* 30 (GH), 3500 m., *Buchtien* 505

(GH), 3700 m., *Hitchcock* 22565 (GH). COCHABAMBA: MIZQUE: Vila-vila, 2500 m., *Eyerdam* 24983 (GH).

19. *Anthochloa* Nees

See Matthei in Gayana, Bot. no. 8: 11-15 (1963).

Anthochloa lepidula Nees & Mey. in Meyen, *Reise*, 2: 14 (1835). *A. rupestris* Remy in Ann. Sci. Nat. (Ser. 3) 6: 347 (1846). Densely caespitose dwarf perennial, less than 10 cm. high. Leaf-blades 0.5-1.5 mm. wide, somewhat scabridulous, often exceeding the inflorescence. Inflorescence a greatly reduced racemose panicle, more or less capitate in appearance, sometimes only 1 spikelet to a panicle-branch. Spikelets about 8 mm. long, with 4-6 perfect florets, the naked rachilla disarticulating above the glumes. Glumes hyaline, the apex sometimes erose, 2 and 2.5 mm. long. Lemmas hyaline, scarious, 4 mm. long and 5 mm. wide, deeply bifid. Palea shorter than lemma, hyaline, deeply 2-3-cleft almost to the base. LA PAZ: LARECAJA: vic. Sorata; Lacatia ad La Apacheta, 4500-5000 m., *Mandon* 1372 (GH).

20. *Orthoclada* Beauv.

Orthoclada laxa (Rich.) Beauv. ex Nees, *Agrost. Bras.* 522 (1829). Perennial, stoloniferous, the culms up to 1 m. high. Leaf-sheaths puberulous, the lance-ovate blades to 15 cm. long, and 2.5 cm. wide, scabridulous above, the base long-petiolately attenuate, glabrous. Inflorescence a terminal racemose panicle, the slender branches ultimately divergent, erect-appressed before maturity. Spikelets usually solitary, disarticulating below the glumes, usually with 1 perfect floret but often 2-flowered, fertile floret below sterile, 6-10 mm. long, the rachilla pubescent. Glumes unequal, to 4 and 5 mm. long, the first 3-nerved, main nerve scabrid, the second 5-nerved, all nerves scabrid on upper portion at least. Lemma to 7 mm. long, obscurely 5-nerved, scabrid-puberulent on upper portion. Palea about 4.5 mm., bicarinate, the keels ciliolate. SANTA CRUZ: ICHILO: Río Vibora, 350 m., *Steinbach* 7576 (GH); SARA: Río Surutú, 400 m., *Steinbach* 7294 (GH).

21. *Zeugites* Schreb.

Zeugites mexicana (Kunth) Trin. ex Steud. *Nomencl.* (ed. 2) 2: 798 (1841). *Z. mexicana* var. *glandulosa* Hack. in Fedde, Rep. Sp. Nov. 6: 758 (1908). A slender much-branched perennial, the wiry culms usually less than 30 cm. high. Leaf-sheaths sparsely pilose, especially at the apex; leaf-blades long-petiolate, the petiole pubescent at base and apex, the blades broadly lance-ovate, acute, up to 3 cm. long and 1.5 cm. wide. Inflorescence a few-branched, few-flowered, open, racemose panicle up to 5 cm. long. Spikelets few-flowered (2-3), the lowest floret perfect, the upper florets staminate and decidedly distant from the lowermost, the naked rachilla disarticulating above the glumes, the spikelet falling as a unit; spikelet to 6 mm. long. Glumes

somewhat unequal, 1.5 and 2 mm. long, herbaceous, often purple-tipped, the second 5-nerved, the 3 central nerves connected by conspicuous transverse veinlets, both glumes with 2-3 very short teeth at apex, and with slightly ciliate margins. Lemmas 3 mm. long, 7-nerved, with a very short central apical tooth. Palea as long as the lemma, strongly bicarinate in the upper portion. LA PAZ: NOR YUNGAS: Coripata, *Bang* 2131 (GH); Bella Vista, *Hitchcock* 22751 (GH). COCHABAMBA: CHAPARE: Incachaca, 2600 m., *Steinbach* 9872 (GH).

22. *Triodia* R. Br.

Triodia avenacea HBK. Nov. Gen. & Sp. 1: 156 (1816). Caespitose dwarf perennial, from 3-10 (-20) cm. high. Leaf-sheaths sparsely pilose, the flat blades to 3 cm. long, 2 mm. wide, falcate, pilose above and beneath (at least when young), obtuse, shortly mucronate. Inflorescence a short (1-4 cm.), dense, terminal, racemose panicle, the rachis villous. Spikelets about 6 mm. long, with up to 5 perfect florets, the naked rachilla disarticulating above the glumes. Glumes unequal, the first 5 mm. long, with a ciliate keel, the second, 7-8 mm. long, exceeding the spikelet, the keel scabridulous. Lowest lemma about 4 mm. long, the lemmas decreasing in size upwards on the rachilla, deeply bifid, with a scabridulous 4 mm. awn arising from the base of the sinus, the 2 lobes shortly 2-toothed, the rounded back densely villous at base, ciliate, the hairs increasing in length toward the apex. Palea much shorter than the lemma, bicarinate, the keels ciliate, long-villous between the keels and the margin. POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 204 (GH).

23. *Pappophorum* Schreb.

Caespitose perennials, the culms 2-5 dm. high. Leaves pubescent or pilose on sheaths and blades, the blades narrow, 1-2 mm. wide, not equaling the inflorescence or sometimes exceeding it. Inflorescence a terminal, narrow, racemose panicle, spicate in appearance. Spikelets 1-3-flowered, the lowest floret perfect, the rest sterile, the puberulent rachilla disarticulating above the thin-textured glumes; lemmas firm or indurate, the apex dissected into numerous awns.

Panicle lead-colored; awns plumose, 3.5-5 mm. long. 1. *P. Wrightii*.
Panicle light to purplish; awns scabrid, 0.5-1 cm. long.

..... 2. *P. mucronulatum*.

1. ***Pappophorum Wrightii*** S. Wats. in Proc. Amer. Acad. 18: 178 (1883). Panicle 2-5 cm. long. Spikelets about 5 mm. long (including the awns). Glumes pilose, the first to 4 mm. long, the second to 5 mm. Lemmas about 1.5-2 mm. long, the awns about 3.5 mm., strongly nerved, short-pilose. Palea as long as the lemma, bicarinate, the keels ciliate, sparsely pubescent between keels and margins. TARIJA: CERCADO: Tarija, *Fries* 1221 (US).

2. ***P. mucronulatum*** Nees, Agrost. Bras. 412 (1829). Panicle 5-10

cm. long. Spikelets about 1.4 cm. long (including the awns). Glumes glabrous, short-awned (awns 1-1.5 mm.), 5 and 6 mm. long. Lemmas about 3.5 mm. long, the awns about 1 cm. long, villous at base externally, internally pubescent, at least at the apex, the nerves not visible on the exterior. Palea as long as the lemma, bicarinate, the keels ciliolate. COCHABAMBA: CERCADO: Cochabamba, *Holway* 367 (US). TARIJA: CERCADO: Tarija, *Fries* 1099 (US).

24. *Agropyron* Gaertn.

Perennial, more or less erect, the culms to 1-2 m. high, basally decumbent, sometimes stoloniferous. Leaf-sheaths usually glabrous but occasionally puberulent; leaf-blades to 12 cm. long and 4 mm. wide, much shorter than the inflorescence, usually glabrous, sometimes puberulent, long-acute. Inflorescence a single spike or raceme, or slightly paniculate (rarely so), the spikelets sessile, subsessile or with a 1 mm. pedicel, sometimes rather unilateral in arrangement. Spikelets solitary, occasionally paired, the rachilla disarticulating above the glumes, few- to several-flowered; glumes awnless, or very short-awned; lemmas awnless or short-awned.

Glumes at least 1 cm. long, with 4-6 prominent nerves; lemmas awnless or shortly mucronulate (mucro 0.75 mm.). 1. *A. attenuatum*.

Glumes less than 1 cm. long, nerves inconspicuous; lemmas with an awn to 7-8 mm. long. 2. *A. breviaristatum*.

1. *Agropyron attenuatum* (HBK.) Roem. & Schult. Syst. Veg. 2: 751 (1817). Spike 7-17 cm. long. Spikelet about 2 cm. long, several-flowered (up to 6), the uppermost a sterile lemma, the 1 below it apparently staminate. Glumes subequal, 1-1.2 cm. long, obtuse. Lowest lemmas 1-1.2 cm. long, lowest shortly tridentate, 5-nerved, its palea 9 mm. long, 2-nerved, the nerves markedly ciliolate. Upper lemmas equal to or slightly shorter than the lowest, the uppermost much shorter. LA PAZ: MURILLO: La Paz, 3700 m., *Buchtien* 8532 (GH); NOR YUNGAS: Pongo, 3640 m., *Hitchcock* 22766 (GH).

2. *A. breviaristatum* Hitchc. in Contrib. U.S. Nat. Herb. 24: 353 (1927). Spikes 10-20 cm. long. Spikelets 1-1.5 cm. long, 3-5-flowered. Glumes subequal, 7-10 mm. long, acuminate, scabridulous, especially on the nerves. Lemmas 8-9 mm. long, scabrid, awned. LA PAZ: OMASUYOS: Isla del Sol, *Asplund* 6461 (*Hitchcock*).

25. *Elymus* L.

Elymus angulatus Presl, Rel. Haenk. 1: 264 (1830). Perennial, culms spreading at base but erect, to 1 m. high, the plants glabrous. Leaf-blades much shorter than the inflorescence, to 6 mm. wide, acute, scabridulous beneath. Inflorescence a terminal spike, with 2 sessile spikelets at a node (rarely solitary ?), the spike, to 15 cm. long. Spikelets about 1.3 cm. long (excluding the awns), up to 6-flowered, always with more than 1 perfect floret, disarticulation above the

glumes; glumes equal or subequal, about 1 cm. long, awn 3 mm. long, apex ciliolate, mid-nerve and awn scabridulous to scabrid, at least on the upper portion of the glume; lemmas distinctly rounded, subterete, about 1 cm. long, awns 4-5 mm. long, scabridulous near the apex, palea nearly as long as the lemma, bicarinate, the keels densely scabrid-ciliate on the upper half; uppermost floret a rudiment, the one below it neuter or possibly sometimes staminate. POTOSÍ: SUR CHICHAS: Oploca, *Hitchcock* 22892 (GH).

26. *Hordeum* L.

Perennials, erect or spreading, or decumbent, sometimes caespitose, usually 2-4 dm. high. Leaves glabrous, the short flat blades to 3 mm. wide, acute, scabridulous beneath, never equaling nor exceeding the inflorescence. Inflorescence a short terminal spike, less than 10 cm. long, with 3 spikelets at a node, the rachis jointed and disarticulating. Spikelets 1-flowered, glumes present, the rachilla disarticulating above the glumes, the lemmas acuminate or shortly or long-awned, the palea bicarinate; central spikelet sessile, the 2 laterals somewhat pedicellate and reduced to slender setose glumes.

Lemmas awnless or very shortly awned; glumes of fertile floret with awns 4 mm. long; rachilla obviously prolonged behind the palea.

..... 1. *H. muticum*.

Lemma with a 6 mm. awn; glumes of fertile floret with awns 1 cm. long; rachilla only slightly or not at all prolonged behind the palea.

..... 2. *H. halophilum*.

1. *Hordeum muticum* Presl, Rel. Haenk. 1: 327 (1830). Spikelet, excluding awns, about 6 mm. long. Glumes reduced virtually to scabridulous awns 4 mm. long. Lemma about 5 mm. long, seldom short-awned. Palea less than 5 mm. long, bicarinate. Sterile glumes reduced to awns 4-5 mm. long. LA PAZ: OMASUYOS: vic. Achacache, 3950 m., *Mandon* 1379 (GH); MURILLO: La Paz, 3750 m., *Buchtien* 55 (GH), *Bang* 179 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 207 (GH). TARIJA: AVILES: Puna Patanca, 3700 m., *Fiebrig* 3193 (GH).

Hordeum nodosum L. Sp. Pl. (ed. 2) 126 (1762) has been ascribed to Bolivia by Hitchcock on the basis of a collection made by Pearce. I have seen no South American material of this species. It is apparently like *H. muticum* but with longer awns.

2. *H. halophilum* Griseb. in Goett. Abh. 19: 249 (1874). Spikelet, excluding awns, about 5 mm. long. Glumes of fertile floret reduced to awns 1 cm. long. Lemma 5 mm. long, with a 6 mm. awn. Palea about 6 mm. long, bicarinate, the apex bidentate. Sterile glumes reduced to awns over 1 cm. long. LA PAZ: MURILLO: La Paz, 3700 m., *Buchtien* 506 (GH).

27. *Lolium* L.

Annual or perennial, 2-8 dm. to 1 m. high. Leaf-blades long, often nearly equaling the inflorescence, to 1 cm. wide, scabridulous beneath. Inflorescence a terminal spike, 2-25 cm. long, the sessile spikelets solitary at the nodes and placed edgewise to the rachis. Spikelets several-flowered, first glume absent from all but the uppermost spikelet, rachilla disarticulating above the glumes, lemmas dorsally rounded, awned or awnless.

- a. Glume to 2 cm. long, usually as long as, often exceeding, the spikelet. 1. *L. temulentum*.
- a. Glume less than 1 cm. long, usually much shorter than the spikelet.
 - b. Lemmas awnless. 2. *L. perenne*.
 - b. Lemmas awned. 3. *L. multiflorum*.

1. *Lolium temulentum* L. Sp. Pl. 83 (1753). Annual. Spikelet 1.5-2 cm. long, with up to 7-8 florets. Second glume to 2 cm. long, almost always longer than the rest of the spikelet, very firm-textured. Lemmas very firm, about 8 mm. long, obscurely nerved, the apex with 2 blunt hyaline teeth and a very short scabrid awn rising from between the bases of the teeth, or the uppermost lemmas sometimes very long-awned. Palea firm-textured, nearly as long as the lemma, the upper margins ciliate. LA PAZ: LARECAJA: vic. Sorata; Cicirca, Munaypata, Mandon 1376 (GH).

1a. *L. temulentum* var. *arvense* (With.) Bab. Brit. Bot. 377 (1843). Differs by awnless lemmas. No material has been seen.

2. *L. perenne* L. Sp. Pl. 83 (1753). Perennial. Spikelet about 1 cm. long, occasionally to 1.5 cm., with up to 10 florets. Second glume about 5 mm. long, more or less obtuse. Lowermost lemmas about 5 mm. long, decreasing in length upward on the spikelet. Palea as long as the lemma, the margins densely and shortly scabrid-ciliate. LA PAZ: MURILLO: La Paz, 3700 m., Buchtien 4487 (GH).

3. *L. multiflorum* Lam. Fl. Franç. 3: 621 (1778). Perennial. Spikelet (excluding awns) to 1.5 cm. long, with up to 10 florets. Second glume about 1 cm. long, rather obtuse. Lemmas to 7 mm. long, the apex bidentate, awns to 6 mm. long. Palea as long as the lemma, the margins ciliate. COCHABAMBA: CERCADO: Valle de Cercado, 2700 m., Steinbach 9549 (GH).

28. *Pariana* Aubl.

See Tutin in Journ. Linn. Soc. Bot. 50: 337-362 (1936).

Perennial, from a creeping scaly rootstock. Leaves few, reduced to sheaths on fertile culms (except in no. 1), leaf-sheaths puberulent to glabrous, the orifice often fimbriate; blades broad, lanceolate to ovate, pubescent to glabrous, often scabrid beneath. Inflorescence condensed, spicate, male spikelets 1-flowered, pedicellate, in whorls of 4-6, usually 5, pedicels often fused marginally, a solitary 1-flowered

female spikelet sessile within the whorl; rachis disarticulating between the whorls. Glumes lateral, flanking the lemma, 1-3 nerved. Lemma ovate to oblong, coriaceous, usually 3-nerved. Palea shorter and thinner than the lemma.

a. Leaf-sheaths without fimbriae at apex; lemmas less than 6 mm. long.

b. Glumes 2-3-nerved; terminal spikelet pistillate. 1. *P. bicolor*.

b. Glumes 1-nerved; terminal spikelet sterile. 2. *P. gracilis*.

a. Leaf-sheaths fimbriate at apex; lemmas about 7 mm. long. 3. *P. Swallenii*.

1. *Pariana bicolor* Tutin in Journ. Linn. Soc. Bot. 50: 355 (1936). Sterile culms to 8 dm. high. Leaf-sheaths imbricate, glabrous, the efimbriate blades to 25 cm. long and 5 cm. wide, oblong to ovate, acuminate, glaucous and scabridulous beneath, glabrous above. Fertile culms to 4.5 dm. high, leaves reduced to sheaths or the uppermost sheath sometimes with a rudimentary blade, sheaths puberulent, the orifice ciliate with short, stiff, white hairs. Inflorescence 5-9 cm. long. Male spikelets in whorls of five, pedicels 2-3 mm. long, puberulous, basally heavily bearded. Glumes 2-2.5 mm. long, acute to acuminate, glabrous or ciliolate, 2-3-nerved, the nerves confluent near the apex. Lemma 3.5-4.5 mm. long, lance-elliptic, acute, midrib prominent, glabrous. Female spikelet: glumes obtuse, 6 mm. long, lemma and palea 6 mm. long. LA PAZ: LARECAJA: Mapiri, 1300 m., *Rusby* 232 (US); San Carlos, Mapiri, 850 m., *Buchtien* 458 (GH; type-number); CAUPOLICÁN: San Buena Ventura, 500 m., *Cárdenas* (M. E.) 1889 (US).

2. *P. gracilis* Doell in Mart. Fl. Bras. 2(2): 337 (1877). Sterile culms leafy, sheaths imbricate, fimbriae lacking. Leaf-blades oblong-lanceolate, to 15 cm. long and 2.5 cm. wide, acuminate. Fertile culms leafless, the inflorescence slender. Male spikelets hardly imbricate, the pedicels to 3 mm. long, pubescent. Glumes to 3 mm. long, acute, 1-nerved. Lemma to 4.5 mm. long, oblong-ovate, acute, glabrous, sometimes red and purplish, the nerves obscure. LA PAZ: CAUPOLICÁN: Mojos, *d'Orbigny* 147 (Tutin).

No material has been available to me and this description has been derived from that of Tutin.

3. *P. Swallenii* R. C. Foster, spec. nov. Culmi steriles ad 6.5 dm., foliati, nodi dense breveque hispidi, vaginae puberulae vel glabrae, ad orem fimbriatae. Laminae (2) inaequales, late ovatae, acutae, ad 30 cm. longae et 10 cm. latae, supra glabrae, subtus glaucae et plus minusve scabridulae. Culmi fertiles ad 2.5 dm., efoliati, pubescentes, vaginis imbricatis glabris vel subpuberulis obtecti. Inflorescentia subcrassa, ad 13 cm. longa. Spiculae masculinae 5 in verticillo, pedicelli ad 3 mm. longi, puberuli, basi barbati, plus minusve coaliti. Glumae ad 4-5 mm. longae, 3-nervatae, acutae vel acuminatae, vel subsetatae, ciliatae, minute papillatae. Lemma 7 mm. longum, ob-

longum, obtusum vel subacutum, glabrum, 5-nervatum, nervis paucis connectentibus prope apicem. Spicula feminea; gluma prima ca. 7-8 mm. longa, 1-nervata, ciliata, puberula; gluma altera breviora, ciliata, glabra, 1-nervata; lemma ca. 6 mm. longum. COCHABAMBA: CHAPARE: Puerto Polonia, Río Coni, 14 km. east of San Antonio, 395 m., Oct., Cárdenas & Cutler 7358 (Typus, in Herb. Gray.).

Since Mr. J. R. Swallen has described a number of new South American species in this genus, it is fitting that this apparent novelty should be named for him.

Pariana lunata Nees, Agrost. Bras. 295 (1829), was ascribed to Bolivia by Hitchcock in his treatment of Andean grasses. The only specimen he cited, however, was sterile. The later monographer, Tutin, saw no Bolivian material, so that its presence in Bolivia is still problematical. Should fertile material be found, it can easily be distinguished from the three other Bolivian species by the fact that the fertile culms bear well-developed leaves rather than, at most, rudimentary leaf-blades.

Pariana zingiberina Doell in Mart. Fl. Bras. 2(2): 337 (1877) was also ascribed to Bolivia by Hitchcock. All the material cited by him was later cited by Tutin under the new species, *P. bicolor* Tutin. No Bolivian material was cited by Tutin for *P. zingiberina*, and it seems almost certain that it is not a member of the Bolivian flora.

To be continued

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Vol. 68

July-September, 1966

No. 775

CONTENTS:

Studies in the Flora of Bolivia — IV.

Robert C. Foster 241

Native North American Species of Lespedeza

(Leguminosae). *Andre F. Clewell* 359

**Environmental Control of a Taxonomic Character Separating
Heterotheca S. Str. from Chrysopsis.**

C. John Burk and Chung-Hie Nah 406

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STUDIES IN THE FLORA OF BOLIVIA — IV

ROBERT C. FOSTER

Continued from Vol. 68, No. 774

29. *Dissanthelium* Trin.

Annual or perennial, the plants seldom over 10 cm. high, caespitose. Leaves glabrous, the blades flat or involute. Inflorescence a short, terminal, racemose panicle, spicate in appearance. Spikelets mostly 2-flowered, occasionally 3-flowered or 1-flowered, the naked rachilla disarticulating above the glumes and prolonged beyond the uppermost floret; glumes equal, longer than the lemmas; glumes and lemmas awnless.

a. Glumes 3 (-3.5) mm. long.

b. Lemma puberulent, obtuse, with a central mucro. 1. *D. macusaniense*.

b. Lemma scabridulous, obtuse, but not toothed. 2. *D. calycinum*.

a. Glumes 5 mm. long.

c. Inflorescence 5-7 mm. broad, compact; spikelets numerous. 3. *D. peruvianum*.

c. Inflorescence less than 5 mm. broad, lax, spikelets few. 4. *D. Trollii*.

1. *Dissanthelium macusaniense* (Krause) Foster and Smith in *Phytologia*, 12: 249 (1965). *D. minimum* Pilger in Engler, Bot. Jahrb. 56, Beibl. 123: 28 (1920). Annual, the leaf-blades flat. Inflorescence 1-2 cm. long, more or less oblong, the rachis, branches and pedicels only faintly scabridulous. Spikelets mostly 2-flowered. Lemma about 2.5 mm. long. POTOSÍ: CERCADO: Potosí, 4000 m., Cárdenas 198 (GH).

2. *D. calycinum* (Presl) Hitchc. in Journ. Wash. Acad. Sci. 13: 224 (1923). Perennial. Inflorescence to 3 cm. long, oval, rachis, branches and pedicels puberulent-scabridulous. Spikelets 2-flowered. Lemma about 2.5 mm. long. Without locality: Bang 1873 (GH).

3. *D. peruvianum* (Nees & Meyen) Pilger in Engler, Bot. Jahrb. 37:

378 (1906). Perennial. Apparently differs from *D. calycinum* primarily in having longer glumes and in spikelets frequently 1-flowered. LA PAZ: LARECAJA: Sorata, *Mandon* 1345 (GH).

4. *D. Trollii* Pilger in *Notizbl.* 11: 778 (1933). Perennial, about 5 cm. tall. Leaves with flat pungent blades to 4.5 cm. long (usually shorter) and 2 mm. wide. Inflorescence narrow, about 2 cm. long (2.5 cm. on the type), the rachis glabrous to scabridulous, pedicels scabridulous, sometimes almost glabrous, or scabrid on the margins and angles. Spikelet to 5 mm. long, 2-flowered. Glumes as long as the spikelet, acute to very acute. Lemmas 4 mm. long, hyaline. Palea hyaline, nearly as long as the lemma, bicarinate, slightly bidentate, the teeth obtuse (when flattened). LA PAZ: MURILLO: Chacaltaya, 4800 m., *Buchtien* 1197 (US); La Cumbre, 5000 m., *Tate* 10 (US), *Parodi* 10042a (US); La Union, 4800 m., *Troll* 1966 (US; type-number).

30. *Koeleria* Pers.

Koeleria cristata (L.) Pers. *Synops. Pl.* 1: 97 (1805). *K. gracilis* subsp. *boliviensis* (Domin) Domin in *Biblioth. Bot.* 65: 237 (1907). *K. pseudocristata* var. *andicola* Domin in *Fedde, Rep. Sp. Nov.* 2: 94 (1906). Perennial, to 5 dm. high, the culms pubescent. Leaves mostly basal, the sheaths from nearly glabrous to pubescent, the flat blades pubescent, at least when young. Inflorescence a dense, terminal, racemose panicle, to 10 cm. long, interrupted at the base, the rachis, branches and pedicels pubescent. Spikelets 2-4-flowered, about 6 mm. long, the rachilla villous, disarticulating above the glumes. First glume 4.5 mm. long, 1-nerved, scabridulous on the nerve; second glume 5 mm. long, 3-nerved, the keel scabridulous. Lowest lemmas 5 mm. long, bidentate, with a 4 mm. awn arising from the base of the sinus, the keel and awn scabridulous. Palea about 4 mm. long, bidentate, the keels ciliate. LA PAZ: NOR YUNGAS: Pongo, 3640 m., *Hitchcock* 22767 (GH).

With the form described here, there is also to be found one in which leaves and culms are more densely pubescent and the lemmas are awnless or, at most, shortly mucronate. Both forms are found on the Gray Herbarium sheet of *Hitchcock* 22767.

31. *Trisetum* Pers.

Perennials, 1-5 dm. high, rarely to 1 m., the leaves and culms glabrous, the leaf-blades involute or flat and sometimes scabridulous. Inflorescence a terminal, dense, racemose panicle, spicate in appearance, interrupted at the base, 2-15 cm. long. Spikelets 2-3-flowered, unilateral, fertile florets below the sterile, disarticulating above the unequal glumes; lemmas awned.

Glumes to 1 cm. long, acuminate, lemmas to 1.5 cm. long, rachilla glabrous. 1. *T. floribundum*.

Glumes to 5 mm. long, acute, lemmas about 5 mm. long or less, rachilla villous. 2. *T. spicatum*.

1. ***Trisetum floribundum*** Pilger in Engler, Bot. Jahrb. 37: 505 (1906). *Dielsiochloa floribunda* of the Catalogue. *Bromus Mandonianus* of the Catalogue. To 3 dm. high, leaf-blades involute. Panicle to 6 cm. long, more or less oval, branches and pedicels scabridulous. Spikelets (excluding awns) about 1.3 cm. long. First glume to 7 mm. long, second to 1 cm. Lemmas deeply bidentate, the narrow teeth resembling awns, the true awn to 1.5 cm. long. Palea to 1 cm. long, bidentate, the keels ciliolate. LA PAZ: LARECAJA: vic. Sorata; ad lacum Turi-guana, 4500 m., Mandon 1371 (GH; type-number of *Bromus Mandonianus*).

2. ***T. spicatum*** (L.) Richt. Pl. Eur. 1: 59 (1890). *T. oreophilum* Louis-Marie in Rhodora, 30: 221 (1928). To 3 dm. high, rarely to 1 m., leaf-blades flat, leaves chiefly basal. Panicle narrow, to 15 cm. long, rachis, branches and pedicels pubescent. Glumes 3.5 and 4 mm. long, the keels scabridulous. Lemmas pubescent to villous, bidentate, the teeth not produced as pseudo-awns, the true awn about 3 mm. long. LA PAZ: MURILLO: La Paz, 3700 m., Buchtien 8540 (GH).

32. *Deschampsia* Beauv.

See Parodi in Darwiniana, 8: 415-475 (1949).

Perennial. Leaf-blades flat or folded. Inflorescence a dense to open racemose panicle, sometimes interrupted below. Spikelets 2-flowered, the villous rachilla prolonged beyond the upper floret, disarticulation above the glumes. Glumes equal or subequal. Lemmas thin to hyaline, the apex obtuse, 2-4-toothed, bearing a dorsal awn at or below the middle.

Panicle dense, the short branches appressed, interrupted below; awn much exceeding the lemma. 1. *D. conferta*.

Panicle lax, the branches long, not appressed; awn equaling or slightly exceeding the lemma. 2. *D. caespitosa*.

1. ***Deschampsia conferta*** (Pilger) Valencia in Revist. Argent. Agron. 8: 127 (1941). *Aira conferta* of the Catalogue. Plant to 10 dm. tall, usually shorter. Leaf-blades linear, flat, scabrid above and beneath, to 3 mm. wide. Panicle dense, to 20 cm. long, rachis glabrous or slightly scabridulous on the upper portion, branches and pedicels scabridulous. Spikelets to 5 mm. long (excluding the awns). Glumes to 5 mm. long, acute, the margins erosulous near the apex, the keel scabridulous. Lemmas about 3 mm. long, deeply bidentate, the teeth more or less acute; awn twisted for 1.5-2 mm., geniculate, scabrid, the whole to 5 mm. long. COCHABAMBA: CERCADO: north of Cochabamba, Hitchcock 22814 (US).

2. **D. caespitosa** (L.) Beauv. Ess. Agrost. 91, 149, 160 (1812). Plant to 1.2 m. tall, densely caespitose. Leaf-sheaths glabrous; blades linear, to 4 mm. wide, flat or folded, scabrid above. Inflorescence an open panicle, to 3 dm. long, the branches rather long, branches and pedicels scabridulous. Spikelets to 4 mm. long, the rachilla sometimes bearing a reduced floret at the apex. Glumes subequal, about 4 mm. long, obtuse and erose to acute, often purple-tinged, thin, obscurely nerved. Lemma 3 mm. long, hyaline, the apex usually several-toothed, the awn equaling or somewhat exceeding the lemma, but not markedly so; palea narrow, slightly shorter than the lemma.

No Bolivian material has been seen. The species is included on the authority of Parodi, l. c., who cites a specimen (collector unknown) from the vicinity of the city of Santa Cruz de la Sierra.

33. *Avena* L.

Annuals up to 7.5 dm. high, the leaf-blades flat, to 4-8 mm. wide, scabrid, occasionally pilose. Panicle lax, the branches distant, racemose, to 25 cm. long, rachis and branches glabrous, the pedicels sometimes puberulous-scabridulous. Spikelets 2-3-flowered, the rachilla villous, disarticulating above the nearly equal, many-nerved, papery glumes; lemmas bidentate, villous on the lower portion at least, awned, the awn arising from mid-lemma or below.

Pedicels spreading, glumes to 2.5 cm. long, lemmas about 2 cm. long, acute. 1. *A. fatua*.

Pedicels flexuous, glumes to 2 cm. long, lemmas about 1.5 cm. long, the teeth setaceous. 2. *A. barbata*.

1. ***Avena fatua*** L. Sp. Pl. 80 (1753). Spikelets (excluding awns) about 2.5 cm. long. Awn to 3.5 cm. long. COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22836 (*Hitchcock*).

2. ***A. barbata*** Brot. Fl. Lusit. 1: 108 (1804). Spikelets (excluding awns) about 1.5-2 cm. long. Awns to 3 cm. long. LA PAZ: MURILLO: Palca, *Pflanz* 2541 (*Hitchcock*).

34. *Holcus* L.

Holcus lanatus L. Sp. Pl. 1048 (1753). Perennial, to 1 m. high. Leaf-sheaths, blades and culms pubescent, the blades flat, about equal to the base of the mature inflorescence, to 6 mm. wide. Inflorescence a terminal, racemose, dense panicle to 10 cm. long, the rachis, branches and pedicels pubescent. Spikelets 2-flowered, the lower floret perfect, the upper staminate, 1 spikelet sessile, 1 pedicellate, the rachilla glabrous, disarticulation above the equal glumes, these to 3.5 mm. long, exceeding the florets, the first obscurely 3-nerved, the keel and upper margins ciliate, the second 3-nerved, broader, keel and margins ciliate,

both glumes mucronulate. Pistillate lemmas 2 mm. long, nerveless, awnless, obtuse, shining, the palea as long as its lemma, the keels ciliolate. Staminate lemmas 2 mm. long, nerveless, with a 1.5 mm. stout hooked awn at apex, the palea shorter than its lemma, the keels ciliolate. LA PAZ:MURILLO: La Paz, 3300 m., *Bang* 155 (GH). COCHABAMBA: TOTORA: Pocona, 2500 m., *Steinbach* 8671 (GH).

35. *Danthonia* Lam. & DC.

Danthonia cirrhata Hack. & Arech. in Arech. Gram. Uruguay, 307 (1894). Perennial, to 6 dm. tall, nodes glabrous. Leaves sparsely papillate-hirsute on sheaths and blades, the narrow blades involute, seldom equaling the inflorescence. Inflorescence a narrow panicle usually less than 10 cm. long, few-flowered. Spikelets several-flowered, the uppermost floret sterile; disarticulation above the glumes; axis glabrous to puberulent, the pedicels puberulent and often pilose at the base. First glume to 1.5 cm. long, long-acute, glabrous, 5-nerved, the central nerve prominent, margins thin to hyaline; second glume similar, about 2 mm. shorter. Rachilla long-plumose at the base, hairs to 5 mm. long, white. Fertile lemmas to 6 mm. long, pilose near margin below the middle, deeply bidentate, the teeth produced as pseudo-awns 5 mm. long, a true awn, twisted, to 1 cm. long, arising at base of sinus between teeth. Palea thin, to 4 mm. long, the 2 keels briefly ciliolate. SANTA CRUZ: VALLEGRANDE: Samaipata, *Herzog* 1706, 3012 (Henrard).

36. *Lamprothyrsus* Pilger

Lamprothyrsus Hieronymi (O. Ktze.) Pilger in Engler, Bot. Jahrb. 37: 58 (1906). *L. Hieronymi* var. *tinctus* Pilger in Engler, Bot. Jahrb. 37: 59 (1906). Perennial, to 2 m. high, leaf-sheaths glabrous, the blades long, involute, scabrid on the upper surface, often nearly equaling the mature inflorescence, the old sheaths ultimately coiled at base of plant. Inflorescence a terminal, racemose panicle to 30 cm. long, fairly open at maturity, rachis glabrous, branches and pedicels often scabridulous. Spikelets (excluding awns and pseudo-awns) about 7 mm. long, with up to 6 florets, the uppermost reduced, disarticulation above the glumes, rachilla villous. Glumes equal or subequal, to 6 mm. long, transparent, without apparent nerves. Body of lemma 3 mm. long, villous, bidentate, the teeth produced as pseudo-awns to 1.7 cm. long, the true awn from the base of the sinus, geniculate shortly above its base, to 2 cm. long. Palea 3 mm. long, keels ciliate, villous between the keels and the margins. LA PAZ: LARECAJA: vic. Sorata; San Pedro, 2650 m., *Mandon* 1360 (GH). SANTA CRUZ: VALLEGRANDE: Cerro La Negra, 1700 m., *Steinbach* 8171 (GH); SARA: Cerro Hosana, 1000 m., *Steinbach* 3453 (GH). TARIJA: ARCE: Bermejo, 1400 m., *Fiebrig* 2099 (GH; type-number of *L. Hieronymi* var. *tinctus*).

37. *Calamagrostis* Adans.

See Tovar in Mem. Mus. Hist. Nat. Javier Prado, no. 11: 3-88 (1960).

Perennials. Leaves flat or involute. Inflorescence a panicle, often reduced and condensed. Spikelets disarticulating above the glumes, 1-flowered, with the rachilla more or less prolonged as a bristle behind the palea. Glumes usually more or less equal. Lemma usually shorter than the glumes, thinner-textured, with a dorsal awn (1 species awnless), callus more or less pilose or glabrous, the hairs of varying lengths.

- a. Lemmas awnless. 3. *C. calderillensis*.
- a. Lemmas awned.
 - b. Lemmas stipitate below callus.
 - c. Panicle very open, not spicate. 2. *C. eminens*.
 - c. Panicle dense, spicate.
 - d. Panicle elongate, slender; awn geniculate. 4. *C. amoena*.
 - d. Panicle short, thick; awn straight.
 - e. Awn shorter than the lemma. 7. *C. chrysantha*.
 - e. Awn exceeding the lemma, mostly by 1 mm. 8. *C. ovata*.
 - b. Lemmas sessile below the callus.
 - f. Rachilla glabrous or with a tuft of hairs at the apex only.
 - g. Rachilla glabrous. 6. *C. rigescens*.
 - g. Rachilla with an apical tuft of hairs.
 - h. Rachilla 2 mm. long; awn 9 mm. long. 27. *C. longiaristata*.
 - h. Rachilla 1 mm. long; awn 6 mm. long. 30. *C. viridiflavescens*.
 - f. Rachilla villous.
 - i. Awn 2-2.5 mm. long.
 - j. Spikelet 3 mm. long. 29. *C. polygama*.
 - j. Spikelet 5-8 mm. long.
 - k. Spikelet to 5 mm. long. 13. *C. curvula*.
 - k. Spikelet to 8 mm. long. 31. *C. spicigera*.
 - i. Awn 4 mm. or more in length.
 - l. Awn less than, equaling, or only slightly exceeding the lemma.
 - m. Inflorescence narrow, dense. 10. *C. cryptolopha*.
 - m. Inflorescence lax.
 - n. Rachilla 1.5 mm. long, the longest hairs to 1.5 mm. long. 19. *C. tarijensis*.
 - n. Rachilla 2-2.5 mm. long, the longest hairs to 4 mm. long. 23. *C. intermedia*.
 - l. Awn distinctly exceeding the lemma.
 - o. Inflorescence lax, sometimes spreading.

- p. Panicle about 1 dm. long. 18. *C. tarmensis*.
- p. Panicle 2 dm. or more in length.
 - q. Lowest branches of panicle naked for 2-5 cm.
 - r. Spikelets to 7-8 mm. long; rachilla-hairs to 2 mm. long. 1. *C. leiophylla*.
 - r. Spikelets to 5-6 mm. long; rachilla-hairs to 4 mm. long. 22. *C. Orbignyana*.
 - q. Lowest branches of panicle spikelet-bearing from nearly the base.
 - s. Rachilla-hairs to 1.5 mm long. 26. *C. recta*.
 - s. Rachilla-hairs to 4 mm. long. 21. *C. antoniana*.
- o. Inflorescence dense, sometimes interrupted, but not spreading.
 - t. Panicle over 10 cm. long.
 - u. Spikelets 4 (-4.5) mm. long. 5. *C. heterophylla*.
 - u. Spikelets 6-8 mm. long.
 - v. Spikelets to 6 mm. long; callus glabrous or nearly so, if a few hairs present, the longest to 0.4 mm. long. 28. *C. densiflora*.
 - v. Spikelets 8 mm. long; callus somewhat villous, the longest hairs to 1 mm. long. 11. *C. glacialis*.
 - t. Panicle less than 10 cm. long.
 - w. Panicle less than 2 cm. long.
 - x. Inflorescence narrow, spicate. 24. *C. minima*.
 - x. Inflorescence dense, ovoid. 15. *C. curta*.
 - w. Panicle 2 cm. or more in length.
 - y. Panicle not interrupted, or only slightly so at the base.
 - z. Pedicels villous. 12. *C. Jamesonii*.
 - z. Pedicels scabridulous to pubescent, or nearly glabrous.
 - aa. Callus densely villous, the longest hairs 1 mm. long. 16. *C. brevifolia*.
 - aa. Callus sparsely short-villous, the longest hairs 0.5 mm. long. 9. *C. vicunarum*.
 - y. Panicle obviously much interrupted.
 - bb. Panicle to 2.5 cm. long. 14. *C. cephalopora*.
 - bb. Panicle 4-9 cm. long.
 - cc. Awn to 7 mm. long. 20. *C. Fiebrigii*.
 - cc. Awn to 4 mm. long.
 - dd. Rachis, branches and pedicels glabrous. 17. *C. violacea*.
 - dd. Rachis, branches and pedicels sparsely scabrid. 25. *C. trichophylla*.

1. *Calamagrostis leiophylla* (Wedd.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 367 (1927). *C. toluccensis* var. *laxiflora* O. Ktze. Rev. Gen. 3(2): 345 (1898). Caespitose, erect, 0.5-1 m. high. Leaf-sheaths glabrous to scabridulous, ligule less than 1 mm. long; leaf-blades flat to subinvolute, to 2.5-3 mm. wide. Inflorescence to 3 dm. long, narrow but lax, at least the lowermost branches whorled, axis glabrous below to sparsely scabridulous above, the branches, branchlets and pedicels scabrid. Spikelets to 5-8 mm. long. Glumes to 5-8 mm. long, acute, obscurely nerved, the keel prominent, scabrid. Lemma sessile below the callus, about 2 mm. shorter than the glumes, bidentate, scabridulous; callus glabrous to sparsely short-villous, rachilla about 2 mm. long, the longest hairs about 2 mm. long, not quite equaling the lemma; awn geniculate, to 5-6 mm. long, inserted at the middle of the lemma and exceeding it. COCHABAMBA: CERCADO: Cochabamba, Holway 379 (US).
2. *C. eminens* (Presl) Steud. Nomencl. (ed. 2) 1: 250 (1840). *C. elegans* (Wedd.) Henrard in Meded. Rijks Herb. Leiden, no. 40: 61 (1921). *Deyeuxia polystachya* Wedd. in Bull. Soc. Bot. France, 22: 177, 178 (1875). *C. eminens* var. *tunariensis* O. Ktze. Rev. Gen. 3(2): 344 (1898). *C. eminens* var. *sordida* O. Ktze. Rev. Gen. 3(2): 344 (1898). Caespitose, somewhat rhizomatous, stout, to 1 m. high, in damp or wet places. Leaf-sheaths glabrous, ligule to 1.8 cm.; leaf-blades involute, finely scabridulous to glabrous. Inflorescence open, to 3 dm. long, the spikelets glomerulate or subglomerulate at the ends of branches and branchlets, the rachis, whorled branches and pedicels glabrous to scabridulous. Spikelets to 4-5.5 mm. long. Glumes to 4-5.5 mm. long, acute and erosulous to subobtuse, the keel faintly prominent. Lemma distinctly stipitate below the callus, about 1 mm. shorter than the glumes, obtuse or truncate and erosulous at the apex; callus densely villous, with hairs up to 3 mm. long; rachilla about 1.5 mm. long, long-villous, the hairs chiefly basal; awn delicate, straight, equaling or shorter than the lemma, inserted below the middle of the lemma. LA PAZ: LARECAJA: vic. Sorata; Chicani, 3600-3800 m., Mandon 1309 (GH), 1310 (GH; co-types of *Deyeuxia elegans*). COCHABAMBA: ARANI: pass, Cordillera de Cochabamba, 4500 m., Eyerdam 24850 (GH).
3. *C. calderillensis* Pilger in Engler, Bot. Jahrb. 42: 72 (1908). Plant to 13 dm. tall. Leaf-sheaths glabrous, ligule about 3 mm. long; leaf-blades flat to somewhat inrolled, to 7 mm. wide, the margins scabrid, otherwise glabrous above and beneath. Inflorescence to 22 cm. long, the rachis, whorled branches and pedicels glabrous. Spikelets to 4 mm. long. Glumes to 4 mm. long, the second glume longer than the first, acute to subobtuse. Lemma as long as the first glume, sessile below the callus, obtuse or truncate; callus glabrous, with an apical ring of short, sparse, fine hairs; rachilla 0.5 mm. long, sparsely villous, the longest hairs less than 1 mm. long, not reaching the middle

of the lemma; awn lacking. TARIJA: CERCADO: Calderillo, 3300 m., *Fiebrig* 3172 (US; type-number).

4. *C. amoena* (Pilger) Pilger in Engler, Bot. Jahrb. 42: 60 (1908). *C. filifolia* (Wedd.) Pilger in Engler, Bot. Jahrb. 42: 67 (1908). To 6 dm. high. Leaf-sheaths glabrous, ligule to 3 mm. long; leaf-blades involute, filiform, minutely scabridulous. Inflorescence 6-15 cm. long, somewhat lax, rachis glabrous below, scabrid above, the whorled branches, branchlets and pedicels scabridulous to scabrid. Spikelets to 5-5.5 mm. long. Glumes to 5-5.5 mm. long, long-acute, entire, the faintly prominent midrib keeled and scabridulous above. Lemma shortly stipitate below the callus, as long as the first glume, scabridulous, with 3-4 very slender, short, apical teeth; callus villous at the apex, the longest hairs 1 mm. long; rachilla to 2 mm. long, the upper portion bristle-like, moderately villous, the longest hairs to 1.5 mm. long, reaching $\frac{2}{3}$ the length of the lemma; awn geniculate, to 4.5 mm. long, much exceeding the lemma, the base twisted, the upper portion straight, inserted well below the middle of the lemma. LA PAZ: LARECAJA: vic. Sorata; Marcamocreani, 3500-3600 m., *Mandon* 1306 (GH); NOR YUNGAS: Milluguaya, 2700-3900 m., *Mandon* 1301 (GH); MURILLO: Talca Chuquiaguilla, *Bang* 805 (GH; type-number).

5. *C. heterophylla* (Wedd.) Pilger in Engler, Bot. Jahrb. 42: 64 (1908). *C. boliviensis* Hack. in Fedde, Rep. Sp. Nov. 6: 156 (1908). Plants to 8 dm. tall. Leaf-sheaths usually glabrous, the ligule to 5 mm. long; blades linear, flat, about 2-4 mm. wide, usually shorter than the inflorescence, glabrous to scabridulous or somewhat short-pilose above and beneath, at least when young. Panicles to 2 dm. long, narrow, dense, interrupted (mostly on the lower half), rachis and branches glabrous, pedicels scabrid, the branches short. Glumes to 4 (-4.5) mm. long, acute, the narrow keel scabridulous. Lemma sessile below the callus, about 0.5-1 mm. shorter than the longer glume, with 3 slender apical teeth, the lateral teeth shorter than the central tooth; callus sparsely short-villous, the hairs not over 0.5 mm. long; rachilla 0.5-1 mm. long, sparsely villous, the longest hairs not over 1 mm. long, about $\frac{1}{3}$ the lemma-length; awn geniculate, to 5.5 mm. long, loosely twisted at the base, inserted at or below the middle of the lemma. LA PAZ: MURILLO: La Paz, 3700 m., *Buchtien* 8834 (GH).

6. *C. rigescens* (Presl) Scribner in Rept. Missouri Bot. Gard. 10: 37 (1899). *Deyeuxia imberbis* Wedd. in Bull. Soc. Bot. France, 22: 177, 180 (1875). Caespitose, rhizomatous, to 3 dm. tall. Leaf-sheaths glabrous, ligule to 1 mm. long; blades involute, shorter than inflorescence, glabrous to somewhat scabridulous. Inflorescence to 1 dm. long, narrow, the branches short, interrupted below, rachis usually glabrous below, puberulent-scabridulous above, branches and pedicels puberulent-scabridulous. Glumes to 5 mm. long, acute, the green midrib keeled and scabridulous above. Lemma about 0.5 mm. shorter than glumes, sessile below the callus, with 3-4 fine, short, apical teeth;

callus sparsely short-villous, the hairs less than 0.5 mm. long; rachilla glabrous, to nearly 2 mm. long; awn straight, to 4-4.5 mm. long, inserted at the middle of the lemma. LA PAZ: MURILLO: near La Paz, 3300 m., *Bang* 104 (GH).

C. chrysantha (Presl) Steud. Nomencl. (ed. 2) 1: 250 (1840). *Deyeuxia phalaroides* Wedd. in Bull. Soc. Bot. France, 22: 177, 180 (1875). *D. leiopoda* Wedd. in Bull. Soc. Bot. France, 22: 177, 180 (1875). *Stylagrostis leiopoda* of the Catalogue. More or less rhizomatous, to 5 dm. tall. Leaf-sheaths glabrous, the ligule to 1.8 cm. long; blades involute, the apex pungent, much shorter than the inflorescence, glabrous, or scabridulous near the apex. Inflorescence golden-brown, oblong, to 6 cm. long, dense, the very short branches ascending, rachis, branches and pedicels mostly glabrous. Glumes to 7 (rarely 8) mm. long, acute or shortly bidentate at the apex, the midrib not prominent. Lemma stipitate below the callus, about 1-1.5 mm. shorter than the longer glume, 2-4-toothed; callus densely villous, the longest hairs 4-5 mm. long; rachilla to 1.5 mm. long, densely villous, the longest hairs to 5 mm. long; awn straight, 2-3 mm. long, shorter than the lemma, quickly deciduous, inserted about 1 mm. above the base of the lemma. LA PAZ: MURILLO: near La Paz, on the road to Coroico, 5000 m., *Mandon* 1319 (GH).

8. **C. ovata** (Presl) Steud. Nomencl. (ed. 2) 1: 254 (1840). *Deyeuxia nivalis* Wedd. in Bull. Soc. Bot. France, 22: 176, 180 (1875). *D. anthoxanthum* Wedd. in Bull. Soc. Bot. France, 22: 176, 180 (1875). *D. capitata* Wedd. in Bull. Soc. Bot. France, 22: 176, 180 (1875). *C. Pflanzii* Pilger in Engler, Bot. Jahrb. 49: 184 (1912). Caespitose, to 3 dm. high. Leaf-sheaths glabrous, the ligule to 1.5 cm. long; blades flat to subinvolute, much shorter than the inflorescence. Panicle golden-brown, to 6-7 cm. long, dense, ovate, the branches short, ascending, rachis and branches mostly glabrous, pedicels sparsely puberulous. Glumes to 1 cm. long (rarely longer), long-acute, the midrib moderately prominent, often scabridulous. Lemma about 4 mm. long, stipitate below the callus, rather deeply bidentate; callus densely villous, the longest hairs 3-4 mm. long; rachilla to nearly 1.5 mm. long, glabrous below, the apical hairs to 3 mm. long; awn straight, mostly exceeding the lemma by about 1 mm., inserted somewhat above the base of the lemma. LA PAZ: LARECAJA: vic. Sorata; Anilaya, 3800-4500 m., *Mandon* 1320 (GH); MURILLO: near La Paz, on the road to Coroico, 5000 m., *Mandon* 1318 (US; type-number of *Deyeuxia nivalis*); NOR YUNGAS: at top of La Cumbre, 4500 m., *Eyerdam* 25112 (GH).

9. **C. vicunarum** (Wedd.) Pilger in Engler, Bot. Jahrb. 42: 62 (1908). *C. pentapogonoides* O. Ktze. Rev. Gen. 3(2): 344 (1898). Plants 5-25 cm. tall, caespitose. Leaf-sheaths glabrous, the ligule to 2 mm. long; blades pungent, filiform, involute, curled or flexuose, shorter (usually) than the inflorescence, glabrous above, the margins

scabrid, puberulous to scabridulous beneath, ultimately glabrescent below. Inflorescence oblong, spicate in appearance, occasionally interrupted below, 2-3 cm. long, the very short branches ascending, appressed, rachis, branches and pedicels rather sparsely scabridulous. Spikelets to 7 mm. long. Glumes as long as the spikelet, long-acute, scabridulous, especially near the upper portion of the scabridulous keel. Lemma sessile below the callus, 2-3 mm. shorter than the glumes, with 3-4 slender apical teeth; callus sparsely-villous, the longest hairs about 0.5 mm. long; rachilla 0.5-0.75 mm. long, slightly villous, the longest hairs about 1 mm. long; awn geniculate, basally twisted, about 5-6 mm. long, inserted 1 mm. above the base of the lemma. LA PAZ: MURILLO: La Paz, 4100 m., *Buchtien* (GH). COCHABAMBA: CERCADO: Putuyuni, 4000 m., *Steinbach* 4086 (GH).

10. *C. cryptolopha* (Wedd.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 374 (1927). To 8 dm. tall. Leaf-sheaths glabrous, the ligule 2-4 mm. long; blades mostly shorter than the inflorescence, nearly filiform, involute, scabridulous. Inflorescence narrow, dense, to 15 cm. long, sometimes interrupted below, the short (to 5 cm.) ascending branches appressed, rachis, branches and pedicels scabridulous. Glumes to about 6 mm. long, long-acute, scabridulous on and near the subprominent keel. Lemma sessile below the callus, about 1-1.5 mm. shorter than the glumes, shortly bidentate; callus rather sparsely villous, the longest hairs about 1 mm. long; rachilla about 1 mm. long, densely villous, the longest hairs about 2 mm. long; awn geniculate, the lower half loosely twisted, 4-5 mm. long, inserted about 1.5 mm. above the base of the lemma. LA PAZ: LARECAJA: Mt. Illampu, 3800 m., *Mandon* 1313 (GH; type-number).

11. *C. glacialis* (Wedd.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 375 (1927). *Deyeuxia picta* Wedd. in Bull. Soc. Bot. France, 22: 177, 180 (1875). Height 3-5 dm. Leaf-sheaths scabridulous, ligule to 6 mm. long; blades shorter than or equaling the inflorescence, involute, stiff, scabridulous to glabrous. Inflorescence tawny-purple, to 20 cm. long, spicate in appearance, the rachis mostly glabrous, branches and pedicels sparingly scabrid on the angles. Glumes to 8 mm. long, acute to long-acute, glabrous to scabridulous, especially on the subprominent keel. Lemma to about 6 mm. long, sessile below the callus, deeply bidentate; callus rather sparsely villous, the longest hairs about 1 mm. long; rachilla about 2 mm. long, densely villous, the longest hairs about 4 mm. long, equaling the lemma; awn about 4 mm. long, straight, exceeding the lemma, inserted at or slightly below the middle of the lemma. LA PAZ: LARECAJA: vic. Sorata; Millipaya, 5000 m., *Mandon* 1312 (GH; type-number); MURILLO: Cerro de Huaina Potosí. *Germaan* 1 (US); Illimani, 4850 m., *Hitchcock* 22590 (GH).

12. *C. Jamesonii* Steud. Syn. Pl. Glum. 1: 191 (1854). Plant 7-33 cm. high, somewhat rhizomatous. Leaf-sheaths glabrous, the ligule to 2 mm. long; blades involute, shorter than or equaling the in-

florescence, obtuse to subacute, glabrous to puberulous. Inflorescence more or less ovoid, dense, 2-4 cm. long, occasionally somewhat interrupted below, the rachis, very short branches and pedicels villous to pubescent. Glumes to 6 mm. long, acute to subacute, glabrous to puberulent, the rather sharp keel pubescent-ciliate. Lemma sessile below the callus, about 4 mm. long, deeply bidentate, the teeth entire or toothed; callus very sparsely short-villous, the longest hairs less than 1 mm. long; rachilla 1.5 (-2) mm. long, densely long-villous, the longest hairs to 4 mm. long, equaling the lemma; awn straight, to 4 mm. long, much exceeding the lemma, inserted well below the middle of the lemma. LA PAZ: MURILLO: Chacaltaya, 4800 m., *Buchtien* 1193 (US).

This description is based on four topotypes, one of which is a probable isotype.

13. *C. curvula* (Wedd.) Pilger in Engler, Bot. Jahrb. 42: 60 (1908). *C. variegata* O. Ktze. Rev. Gen. 3(2): 354 (1898). Densely caespitose rhizomatous plants, to 3 dm. high. Leaf-sheaths glabrous, the ligule to 2 mm. long; blades involute, pungent, filiform, arcuate, scabridulous. Inflorescence spicate in appearance, oblong, to 4.5 cm. long (rarely to 7 cm.), the short branches ascending, rachis and branches glabrous, the pedicels glabrous to sparsely puberulent. Glumes to 5 mm. long, acute, glabrous, the keels scabridulous. Lemma sessile below the callus, about 3.5 mm. long, bidentate, the teeth broad and erosulous; callus villous, the longest hairs about 1 mm. long; rachilla about 2 mm. long or slightly longer, the longest hairs equaling or exceeding the lemma; awn straight to flexuose, but not geniculate, about 2 mm. long, equaling the lemma, inserted at the middle of the lemma or lower. POTOSÍ: SUR CHICHAS: Atocha, *Hitchcock* 22873 (GH).

14. *C. cephalantha* Pilger in Engler, Bot. Jahrb. 42: 61 (1908). *Deyeuxia Lagurus* Wedd. in Bull. Soc. Bot. France, 22: 176, 180 (1875). Dwarf caespitose plants, usually to 4 cm. high, occasionally to 15 cm. high. Leaf-sheaths glabrous, inflated, the ligule to 2.5 mm. long; blades involute, 8 mm. to 2 cm. long, pubescent. Inflorescence ovate, to 2.5 cm. long, the very short branches ascending, rachis, branches and pedicels puberulent-scabridulous. Glumes to about 6 mm. long, acute, glabrous to puberulous above. Lemma sessile below the callus, to 4.5 mm. long, the apex several-toothed; callus densely villous, the longest hairs to 1 mm. long; rachilla to 3 mm. long, densely villous, the longest hairs to 4 mm. long, much exceeding the lemma; awn geniculate, the lower half twisted, to 6.5 mm. long, inserted somewhat below the middle of the lemma. LA PAZ: MURILLO: Chacaltaya, 4800 m., *Buchtien* 1195 (US).

15. *C. curta* (Wedd.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 376 (1927). Perennial, probably less than 10 cm. tall. Leaf-sheaths glabrous; blades glabrous, to 2.5 cm. long and less than 1 mm. wide,

flat or semi-involute, obtuse. Inflorescence a short, condensed, ovate panicle, less than 2 cm. long, the branchlets and pedicels puberulent. Glumes 6 mm. long, the midrib carinate and ciliate, upper portion of glumes scabridulous. Lemma nearly 4 mm. long, the apex with 4 short fine teeth; callus sparsely short-villous, the hairs about 0.5 mm. long; rachilla to nearly 2 mm. long, villous, the hairs about 1 mm. long; awn 4 mm. long, geniculate, inserted below the middle of the lemma and exceeding it. LA PAZ: LARECAJA: vic. Sorata, 4200 m., *Mandon* 1316 (US; type-number).

16. *C. brevifolia* (Presl) Steud. Nomencl. (ed. 2) 1: 240 (1840). Caespitose cushion-plants, the culms 2-4 dm. tall. Leaf-sheaths glabrous, the ligule to 2 mm. long; blades involute, filiform, arcuate or flexuose, pungent, scabridulous above, glabrous beneath, 2-10 cm. long. Inflorescence somewhat dense, oblong to oblong-ellipsoid, 3-7 cm. long, the short branches ascending-appressed or somewhat spreading at the base, the rachis usually glabrous, or sometimes sparsely puberulous or scabridulous, branches and pedicels glabrous to pubescent. Glumes to 7 mm. long, acute to subobtuse, the keel subprominent and scabridulous above. Lemma sessile below the callus, to 5 mm. long, the apex 3-4-toothed, the teeth short, delicate; callus densely villous, the longest hairs about 1 mm. long; rachilla to 3 mm. long, densely villous, the longest hairs to 4 mm. long, equaling or slightly exceeding the lemma; awn straight or flexuose, to 4 mm. long, slightly exceeding the lemma, inserted about 1.5-2 mm. above the base of the lemma. LA PAZ: MURILLO: La Paz, *Asplund* 6519 (Hitchcock).

17. *C. violacea* (Wedd.) Hack. ex Buchtien, Contrib. Fl. Bolivia, 1: 75 (1910). Caespitose, to 3 dm. tall. Leaf-sheaths puberulent-scabridulous, at least when young, the ligule acute, to 4 mm. long; blades filiform, involute, pungent, arcuate, scabridulous-puberulent, shorter than the inflorescence. Inflorescence rather open, to 6 cm. long, the branches 1.5-2.5 cm. long, rachis, branches and pedicels glabrous. Glumes to 6 mm. long, acute to shortly setaceous, purplish dorsally, the keel prominent and scabridulous above. Lemma about 0.5-1 mm. shorter than the glumes, sessile below the callus, with 3-4 short setaceous teeth at the apex; callus densely villous, the longest hairs to 2 mm. long; rachilla densely villous, the longest hairs 3 mm. long, equaling the lemma; awn straight or flexuose, about 4 mm. long, somewhat exceeding the lemma, inserted above the middle of the lemma. LA PAZ: OMASUYOS: near Achacache, 3950 m., *Mandon* 1307 (GH).

18. *C. tarmensis* Filger in Engler, Bot. Jahrb. 42: 70 (1908). *C. rosea* var. *macrochaeta* Hack, in Fries in Ark. Bot. 8: 40 (1908). Plants caespitose in dense tufts or fans, to 8 dm. tall. Leaf-sheaths glabrous, the truncate ligule 2-3 mm. long, erose; blades involute, filiform, flexuose to arcuate, stiffly coriaceous, scabridulous, shorter than to equaling the inflorescence. Panicle lax, 4-11 cm. long, narrow,

the branches ascending and appressed to somewhat spreading, rachis, branches and pedicels scabridulous to scabrid. Glumes 5-6 mm. long, acute, the keel prominent and scabridulous above. Lemma sessile below the callus, 4 (-5) mm. long, with 3-4 fine, short, apical teeth, sometimes scabridulous above; callus sparsely short-villous, the longest hairs about 0.8 mm. long; rachilla about 2 mm. long, rather sparsely villous, the longest hairs 1.5-2 mm. long; awn geniculate, the tightly twisted basal half not equaling nor exceeding the glumes, inserted about 1 mm. above the base of the lemma, at least 6 mm. long. COCHABAMBA: CERCADO: south side of Mt. Tunari, 3600 m., *Steinbach* 9783, 9785, 9788 (all GH).

19. *C. tarijensis* Pilger in Engler, Bot. Jahrb. 42: 71 (1908). Plants caespitose, to 9 dm. tall. Leaf-sheaths glabrous to scabridulous, the ligule to 2 mm. long, acute or subacute; blades involute, scabridulous. Panicle to 20 cm. long, lax, the branches to 5-6 cm. long, rachis, branches and pedicels scabridulous. Glumes about 5 mm. long, acute, the keel prominent and scabridulous above. Lemma sessile below the callus, about 4 mm. long, somewhat scabridulous above, with 4 short, slender, apical teeth; callus villous, the hairs to 1 mm. long; rachilla 1.5 mm. long, longest hairs to 1.5 mm.; awn geniculate, basal half twisted, equaling or exceeding the glumes, 6 mm. or more in length, inserted 1.5 mm. above the base of the lemma. COCHABAMBA: CERCADO: Mt. Tunari, 3600 m., *Steinbach* 9873 (GH). TARIJA: AVILES: Pinos, *Fiebrig* 3119 (GH).

20. *C. Fiebrigii* Pilger in Engler, Bot. Jahrb. 42: 68 (1908). Caespitose, to 3 dm. tall. Leaf-sheaths glabrous, the ligule to 4 mm. long, acute; blades involute, erect, finely scabridulous beneath. Inflorescence 4-6 cm. long, rather dense, the short branches ascending, appressed, rachis and branches glabrous to scabridulous, the pedicels hispidulous. Glumes to 6 mm. long, acute, the keel scabridulous. Lemma sessile below the callus, to 5 mm. long, acute, shortly bidentate; callus villous, longest hairs 1 mm. long; rachilla 2.5 mm. long, villous, the longest hairs 3 mm. long, nearly equaling the lemma; awn geniculate, to 7 mm. long, basal half tightly twisted, inserted about 1.5 mm. above the base of the lemma and much exceeding it. TARIJA: CERCADO: Calderillo, 3300 m., *Fiebrig* 3191 (US; type-number).

21. *C. Antoniana* (Griseb.) Steud. ex Hitchc. in Contrib. U. S. Nat. Herb. 24: 378 (1927). Caespitose, somewhat rhizomatous bunch-grass, to 6-8 dm. high. Leaf-sheaths usually glabrous, sometimes scabridulous, the ligule to 12 mm. long, acute; blades nearly as long as the inflorescence, involute, stiff, pungent, more or less scabridulous. Inflorescence narrow but rather lax, to 2 dm. long (but usually shorter?), the branches to 3-4 cm. long, ascending-appressed to somewhat spreading, rachis and branches mostly glabrous, the pedicels sparsely scabrid-puberulent, especially near the apex. Glumes to 7 mm. long, acute to subacuminate, the keel scabridulous. Lemma sessile below the callus,

about 5 mm. long, scabridulous, bidentate, the thin teeth shortly bidentate; callus villous, the longest hairs to 1 mm. long; rachilla 1-1.5 mm. long, villous, the longest hairs to 4 mm. long, distinctly exceeding the lemma; awn geniculate to flexuose, the basal portion loosely twisted, to 4-6 mm. long, much exceeding the lemma, inserted at or somewhat below its middle. LA PAZ: MURILLO: La Cumbre, *Asplund* 6514 (US).

22. *C. Orbignyana* (Wedd.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 378 (1927). Caespitose, to 8 dm. tall. Leaf-sheaths glabrous, the ligule to 3 mm. long, acute to obtuse, emarginate to bidentate; blades filiform, involute, flexuose, much shorter than the inflorescence, scabridulous, the margins scabrid-ciliate. Inflorescence to 2 dm. long, narrow but lax, the branches to 4-5 cm. long, ascending to somewhat spreading, rachis and branches glabrous, the pedicels very sparsely scabrid to glabrous. Glumes about 5-6 mm. long, the keel scabridulous. Lemma sessile below the callus, 4-5 mm. long, very shortly 3-toothed; callus villous, the longest hairs 1.5 mm. long; rachilla 2 mm. long, villous, the longest hairs to 4 mm. long, equaling or slightly exceeding the lemma; awn about 4 mm. long, somewhat geniculate, the lower half loosely twisted, inserted at or below the middle of the lemma and somewhat exceeding it. LA PAZ: MURILLO: La Paz, 3750 m., *Buchtien* 180 (GH).

23. *C. intermedia* (Presl) Steud. Nomencl. (ed. 2) 1: 250 (1840). *C. Humboldtiana* of the Catalogue. *Deyeuxia gracilis* Wedd. in Bull. Soc. Bot. France, 22: 179 (1875). *D. Mandoniana* Wedd. in Bull. Soc. Bot. France, 22: 179, 180 (1875). Caespitose, rhizomatous, 3-10 dm. high. Leaf-sheaths finely scabridulous to glabrous, the ligule to 1 cm. long, apically narrowed and toothed; blades involute, stiff, coriaceous, usually about as long as the inflorescence, or at least reaching its base, scabridulous, pungent. Inflorescence to 30 cm. long, lax, the lowest branches sometimes to 8-10 cm. long, ascending-spreading, somewhat interrupted, the rachis mostly glabrous, branches and pedicels quite sparsely scabrid. Glumes to 7 mm. long, acute to acuminate, the keels apically scabridulous. Lemma sessile below the callus, to 6 mm. long, usually densely scabridulous-puberulous, bidentate, the slender teeth bidentate; callus villous, the longest hairs nearly 1 mm. long, rarely a little longer; rachilla 2-2.5 mm. long, villous, the longest hairs about 4 mm. long, equaling the lemma; awn geniculate, twisted, inserted well below the middle of the lemma and much exceeding it. LA PAZ: MURILLO: La Paz, 4100 m., *Buchtien* 123 (GH); Palca, 3800 m., *Buchtien* 122 (GH); LARECAJA: vic. Sorata; Velatulini, 3700 m., *Mandon* 1308 (GH; type-number of *Deyeuxia Mandoniana*).

24. *C. minima* (Pilger) Tovar in Mem. Hist. Nat. Javier Prado, no. 11: 52 (1960). Dwarf, pulvinate, to 6 cm. tall. Leaf-sheaths glabrous, the ligule less than 0.5 mm. long, apically truncate and

ciliate, blades to 1 cm. long, involute, the apex obtuse, margins scabrid-ciliate. Inflorescence to 1.5 cm. long, narrow, spicate in appearance, few-flowered, the rachis, branches and pedicels glabrous to sparsely scabridulous. Glumes to 5.5 mm. long, acute, the upper margins sometimes erosulous, the keel scabridulous above. Lemma sessile below the callus, about 4 mm. long, scabridulous above, with several very fine apical teeth; callus villous, the longest hairs less than 1 mm. long; rachilla about 0.5 mm. long, sparsely villous, the longest hairs to 1 mm. long; awn nearly 5 mm. long, geniculate, inserted about 0.5 mm. above the base of the lemma and much exceeding it. LA PAZ: MURILLO: La Paz, 4200 m., *Asplund* 6518 (US); La Cumbre, 4650 m., *Asplund* 6511 (US); Chacaltaya, 4800 m., *Buchtien* 1202 (US).

25. *C. trichophylla* Pilger in Engler, Bot. Jahrb. 42: 67 (1908). Caespitose, rhizomatous, to 5 dm. high. Leaf-sheaths glabrous, the ligule to 2.5 mm. long, subobtuse; blades involute, filiform, flexuose to straight, margins scabridulous, subacute to obtuse, shorter than the inflorescence. Inflorescence lax, open, narrow, to 9 cm. long, rachis, branches and pedicels sparsely scabrid. Glumes to 5 mm. long, acute, the keel scabridulous. Lemma sessile below the callus, about 3.5 mm. long, bidentate, the slender teeth bidentate; callus villous, the longest hairs about 1 mm. long; rachilla to 1.5 mm. long, sparsely villous, the longest hairs somewhat less than 1 mm. long; awn 4 mm. long, geniculate, inserted less than 1 mm. above the base of the lemma and exceeding it. COCHABAMBA: CHAPARE: 50 km. northeast of Cochabamba, on road to Chimoré, 1700 m., *Eyerdam* 25038 (GH).

26. *C. recta* (HBK.) Trin. ex Steud. Nomencl. (ed. 2) 1: 251 (1840). **Deyeuxia sulcata* Wedd. in Bull. Soc. Bot. France, 22: 178, 180 (1875). Bunch-grass, to 9 dm. high. Leaf-sheaths glabrous or scabridulous near the apex, ligule to 5 mm. long, truncate, the apex erose; blades involute, stiff, obtuse, nearly equaling or exceeding the inflorescence. Panicle to 25 cm. long, lax, interrupted, the lower branches to 7-8 cm. long, rachis, branches and pedicels scabrid to hispidulous. Glumes to 7 mm. long, acute, the prominent keel scabridulous. Lemma sessile below the callus, about 5 mm. long, bidentate; callus villous, the longest hairs somewhat less than 1 mm. long; rachilla to 2 mm. long, the longest hairs about 1.5 mm. long; awn geniculate, to 6-7 mm. long, inserted 1.5-2 mm. above the base of the lemma and much exceeding it. LA PAZ: LARECAJA: vic. Sorata; Puerta del Inca, 3700 m., *Mandon* 1308 bis (GH; type-number of *Deyeuxia sulcata*). COCHABAMBA: CERCADO: Cuesta Tabacruz, Tunari, 4500 m., *Steinbach* 9789 (GH).

27. *C. longiaristata* (Wedd.) Hack. in Sodiro in Anal. Univ. Quito, 1889: 8 (1998). *C. Beyrichiana* of the Catalogue. *C. montevidensis* var. *linearis* Hack. in Fedde, Rep. Sp. Nov. 6: 156 (1908). Plant to 8 dm. tall. Leaf-sheaths glabrous, the ligule to 4 mm. long, truncate, lacinate-dentate; blades flat, to 20 cm. long and 7 mm. wide, scabrid

* DEYEUXIA

above and beneath. Inflorescence lax, open, to 2.5 dm. long, the lowest branches up to 15 cm. long, ascending-spreading to arcuate, rachis, branches and pedicels scabridulous. Glumes to 6 mm. long, very narrow, acute, the inconspicuous keel finely scabridulous. Lemma sessile below the callus, to 4.5 mm. long, acute, bidentate; callus densely villous, longest hairs as long as the lemma; rachilla nearly 2 mm. long, the lower portion glabrous, the apex sparsely villous with hairs 2.5-3 mm. long; awn to 9 mm. long, straight, divergent from the very base, inserted well above the middle of the lemma and far exceeding it. LA PAZ: NOR YUNGAS: Unduavi, *Buchtien* 8910 (US); SUR YUNGAS: Sirupaya, *Buchtien* 430 (US).

28. *C. densiflora* (Presl) Steud. Nomencl. (ed. 2) 1: 250 (1840). Caespitose, to 6 dm. tall. Leaf-sheaths glabrous, the ligule to 7 mm. long, subtruncate, erose-dentate; blades involute, acute to pungent, to 15 cm. long, scabridulous. Inflorescence to 18 cm. long, dense, the short ascending branches appressed, rachis, branches and pedicels scabridulous-puberulous. Glumes about 6 mm. long, acute, scabridulous on the upper portion and keel. Lemma sessile below the callus, almost as long as the glumes, somewhat scabridulous, bidentate; callus glabrous or with a very few hairs to 0.4 mm. long; rachilla about 2 mm. long, villous, the longest hairs 3 mm. long; awn straight, to 5 mm. long, inserted at or below the middle of the lemma and exceeding it. LA PAZ: MURILLO: Palca, *Pflanz* 296 (US).

The *Pflanz* specimen is without data except for the number. However, I have records for his nos. 295 and 297, which were collected at Palca. Thus, it seems probable that this is the locality for no. 296.

29. *C. polygama* (Griseb). Parodi in *Physis*, 9: 13, 14 (1928). *C. Lilloi* of the Catalogue. Caespitose, to 1-1.8 m. high. Leaf-sheaths glabrous, the ligule to 2.5 mm. long, acute to subobtuse; blades flat to folded, shorter than the inflorescence, scabridulous. Inflorescence a lax open panicle to 4 dm. long and 15 cm. wide, the spreading branches distant, rachis, branches and pedicels scabridulous. Glumes 3 mm. long, acute, scabridulous on the keel. Lemma sessile below the callus, as long as the glumes or a little longer, scabridulous, bidentate; callus villous, the longest hairs 0.8 mm. long; rachilla 1.5 mm. long, the longest hairs 1.5 mm. long, equaling the lemma; awn flexuose, about 2 mm. long, inserted shortly below the middle of the lemma and about equaling it. COCHABAMBA: CERCADO: west of Cochabamba, *Hitchcock* 22838 (GH); Vinto, 2500 m., *Parodi* 10234 (Parodi).

30. *C. viridiflavescens* (Poir.) Steud. Nomencl. (ed. 2) 1: 251 (1840). *C. montevidensis* of the Catalogue. Plant to 1 m. tall. Leaf-sheaths glabrous, ligule about 1 mm. long, deeply dissected-fimbriate; blades flat, to 7 mm. wide, usually much shorter than the inflorescence, scabridulous above and beneath. Inflorescence to 3 dm. long, loose, rather narrow, somewhat nutant, the lower branches sometimes to 10

cm. long, rachis and branches mostly glabrous, the pedicels scabridulous. Glumes to 4 mm. long, acute to acuminate, the keel scabridulous. Lemma sessile below the callus, about 3 mm. long, bidentate, the 2 teeth shortly fimbriate; callus densely villous, the longest hairs exceeding the lemma; rachilla about 1 mm. long, glabrous except for a very few hairs at the apex, hairs to 2.5 mm. long; awn divergent from the base, straight, about 6 mm. long, inserted above the middle of the lemma and much exceeding it. LA PAZ: SUR YUNGAS: San Felipe, 2800 m., *Hitchcock* 22601 (GH).

31. *C. spicigera* (Presl) Steud. Nomencl. (ed. 2) 1: 251 (1840). *Deyeuxia obtusata* Wedd. in Bull. Soc. Bot. France, 22: 177, 180 (1875). *D. subsimilis* Wedd. in Bull. Soc. Bot. France, 22: 178, 180 (1875). Stoloniferous, to 5 dm. tall. Leaf-sheaths glabrous, the ligule to 2 mm. long; blades involute, arcuate to flexuose, usually glabrous, occasionally puberulous, mostly shorter than the inflorescence. Inflorescence to 6 cm. long, dense, spicate in appearance, the short branches ascending, appressed, rachis glabrous to puberulent, branches and pedicels puberulent to hispidulous. Glumes to 8 mm. long, acute, the keel scabridulous. Lemma sessile below the callus, to 6.5 mm. long, bidentate, the 2 teeth bidentate; callus villous, the longest hairs to 2 mm. long; rachilla to 2.5 mm. long, villous, the longest hairs to 5 mm. long, equaling or slightly exceeding the lemma; awn geniculate, the basal portion twisted, inserted about 2 mm. above the base of the lemma and equaling or slightly exceeding it. LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1311 (Tovar).

38. *Agrostis* L.

Perennials. Leaf-blades flat to involute. Inflorescence a terminal racemose panicle, from dense and spicate in appearance to lax and diffuse. Spikelets 1-flowered, disarticulation above the glumes. Glumes subequal, or, if unequal, the first longer than the second. Lemma hyaline, awned or awnless, much shorter than the glumes; palea present and obvious, or very minute, or absent.

- a. Panicle sometimes narrow, but open to diffuse, not spicate.
 - b. Panicle narrow, spikelets many.
 - c. Palea present, obvious.
 - d. Lemmas awned. 1. *A. gelida*.
 - d. Lemmas awnless. 2. *A. stolonifera*.
 - c. Palea absent or very minute. 8. *A. exasperata*.
 - b. Panicle open to diffuse, spikelets few.
 - e. Lemmas awnless. 5. *A. perennans*.
 - e. Lemmas awned.
 - f. Spikelets all long-pedicellate. 4. *A. montevidensis*.
 - f. Spikelets partly short-pedicellate, partly long-pedicellate. 6. *A. boliviana*.
- a. Panicle narrow, but not open nor diffuse, sometimes spicate.

- g. Palea present. 3. *A. verticillata*.
 g. Palea absent.

h. Panicle spicate; lemma 1.5 mm. long.

- i. Panicle short (to 7 cm.), not interrupted. 7. *A. Haenkeana*.

i. Panicle long (to 15 cm.), interrupted, at least on the lower half. 10. *A. toluensis*.

h. Panicle narrow, loose; lemma 2 mm. long. 9. *A. araucana*.

1. *Agrostis gelida* Trin. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 4(1): 343 (1841). Laxly caespitose, to 1 m. tall. Leaf-sheaths glabrous to scabridulous, ligule to 8 mm. long, abaxially pubescent; blades often long, flat, to 7-8 mm. wide, usually narrower, scabridulous beneath. Panicle narrow but lax, to 3 dm. long, the primary branches verticillate, bearing spikelets only from well above the middle, rachis mostly glabrous, branches and pedicels sparsely to densely scabridulous to scabrid. Glumes 3-4 mm. long, acuminate to subaristate, more or less sparsely scabridulous. Lemma to 2 mm. long, more or less truncately obtuse at the apex, the straight awn about 3 mm. long, inserted below the middle of the lemma and equaling or exceeding the glumes; palea nearly as long as the lemma, about 1.5 mm. LA PAZ: MURILLO: Pongo, *Hitchcock* 22781 (US).

2. *A. stolonifera* L. Sp. Pl. 62 (1753). Basally spreading, the culms to 5 dm. long. Leaf-sheaths glabrous, the ligule to 6 mm. long, glabrous; blades flat, to 3 mm. wide, scabridulous above and beneath. Panicle to 20 cm. long, rather open but narrow, the primary branches verticillate, rachis glabrous, the branches bearing spikelets nearly to the base, the branches and pedicels scabridulous to nearly glabrous. Glumes to 2-2.5 mm. long, acute, the keel scabridulous on the upper half. Lemma about 1.5 mm. long, acute to subobtuse, awnless (rarely awned); palea half as long as the lemma, obtuse. LA PAZ: MURILLO: Pongo, *Hitchcock* 22784 (US).

3. *A. verticillata* Vill. Prosp. Pl. Dauph. 16 (1779). Decumbent to spreading, sometimes stoloniferous, the culms to 5 dm. long (rarely up to 1 m.). Leaf-sheaths glabrous, the ligule 4-5 mm. long, abaxially short-scabrid, apically ciliate-fimbriate; blades mostly short, flat, to 7 mm. wide, scabrid above and beneath. Panicle dense, interrupted, to 15 cm. long, rachis glabrous, branches and pedicels mostly glabrous, occasionally sparsely scabridulous, the verticillate primary branches short, bearing spikelets to the base. Glumes about 2 mm. long, acute, scabridulous, the keel scabrid. Lemma awnless, about 1-1.5 mm. long, obtuse and toothed at the apex; palea as long, or nearly so. COCHABAMBA: CERCADO: Valle de Cochabamba, 2600 m., *Steinbach* 8773 (GH).

4. *A. montevidensis* Spreng. ex Nees, Agrost. Bras. 403 (1829). Slender, erect, culms to 2-3 dm. high. Leaf-sheaths glabrous, ligule to 4 mm. long, apically rounded, glabrous; blades short, flat, 1(-3)

mm. wide, scabridulous above and beneath. Panicle rather diffuse, rachis, branches and elongated pedicels variously scabridulous, primary branches verticillate and bearing spikelets only near the apex. Glumes 2-3 mm. long, acute, the keels scabrid. Lemma about 1.5 mm. long, the awn to 3.5 mm. long, geniculate, inserted nearly at the base of the lemma; palea absent. COCHABAMBA: CHAPARE: Llanta-Aduana, 2800-3200 m., *Steinbach* 8830 (GH, US); Cerro San Benito, 3400 m., *Steinbach* 9649 bis (GH).

5. **A. perennans** (Walt.) Tuckerm. in Amer. Journ. Sci. 45: 44 (1843). Decumbent to erect, the culms to 5-10 dm. high. Leaf-sheaths glabrous, ligule to 5 mm. long, glabrous, narrowed above, the apex obtuse and sparsely erose-dentate; blades relatively short, flat, to 3 mm. wide, scabridulous above and beneath. Panicle open, to 2 dm. long, rachis, branches and pedicels glabrous, the primary branches verticillate, rebranched, the spikelets borne at or near the apices on long pedicels. Glumes 2-3 mm. long, acute to acuminate, the keels sometimes scabridulous near the apex. Lemma 1.5-2 mm. long, bidentate, awnless or with a short awn (to 1.25 mm.) inserted at base of sinus between the teeth; palea absent or extremely minute. LA PAZ: MURILLO: Unduavi, 3200 m., *Buchtien* 2585 (GH); NOR YUNGAS: Bella Vista, *Hitchcock* 22757 (GH). COCHABAMBA: CHAPARE: Incachaca, 2250 m., *Steinbach* 9497 (GH); La Aduana, 2850-3000 m., *Steinbach* 9695 (GH).

6. **A. boliviana** Mez in Fedde, Rep. Sp. Nov. 18: 1 (1922). Somewhat lax, culms to nearly 6 dm. tall. Leaf-sheaths glabrous, the ligule to 6 mm. long, glabrous, apex bluntly rounded to deeply fimbriate; blades about 3 mm. wide, scabridulous above and beneath. Panicle open, to 18 cm. long, the rachis and branches glabrous, the pedicels sometimes sparsely scabridulous, the primary branches rebranched verticillately, the long-pedicellate spikelets borne toward the ends of the secondary branches. Glumes to 3.5 mm. long, acute, the keel finely scabridulous above. Lemma 2 mm. long, deeply bidentate, the flexuose to geniculate awn to 4.5 mm. long, inserted below the middle of the lemma; palea absent. TARIJA: CERCADO: Calderillo, 3200 m., *Fiebrig* 2905 (GH).

7. **A. Haenkeana** Hitchc. in Contrib. U. S. Nat. Herb. 24: 381 (1927). Caespitose, spreading to erect, the culms to 5 dm. tall, but usually much shorter. Leaf-sheaths glabrous, the ligule to 4 mm. long, rounded or fimbriate-dentate at the apex, glabrous; blades usually short, to 3 mm. wide, flat to involute, glabrous above and beneath. Panicle dense, spicate in appearance, to 7 cm. long, rachis, branches and pedicels glabrous, or the pedicels scabridulous, the short branches erect, appressed, bearing spikelets to the base (the lowest spikelets often aborted and reduced to pedicellate rudiments). Glumes to 3.5 mm. long, acute, somewhat scabridulous, the keel scabridulous above. Lemma 1.5 mm. long, the apex truncate and finely denticulate,

awned, the awn straight, flexuose or geniculate, to 2.5 mm. long, inserted above the middle of the lemma; palea absent or extremely minute. LA PAZ: LARECAJA: Puerto del Inca, 3800 m., *Mandon* 1292 (GH).

8. *A. exasperata* Trin. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 4(1): 352 (1841). Erect to decumbent, the culms to 1 m. tall, usually shorter. Leaf-sheaths glabrous, the ligule to 5 mm. long, abaxially scabrid or scabridulous, the apex subobtuse to truncately acute, erose-dentate; blades flat, to 3-4 mm. wide, scabridulous above and beneath. Panicle rather dense, subpyramidal, to 15 cm. long, the rachis glabrous below, scabridulous above, the whorled primary branches and pedicels scabridulous to scabrid. Glumes mostly 3 mm. long, acute to long-acuminate and subaristate, densely scabridulous to scabrid, the keel markedly scabrid. Lemma to 1.5 mm. long, rather deeply bidentate, the straight awn to 2.5 mm. long, inserted at the middle of the lemma and equaling or very slightly exceeding the glumes; palea about 0.4 mm. long. LA PAZ: MURILLO: Palca, *Buchtien* 2531 (US).

9. *A. araucana* Phil. in Anal. Univ. Chile, 94: 14 (1896). Caespitose, to 5 dm. tall. Leaf-sheaths glabrous, the ligule to 4 mm. long, abaxially scabridulous, the apex truncate and dentate; blades flat to loosely involute, to 3 mm. wide, scabridulous above and beneath. Panicle narrow, to 15 cm. long, the rachis, ascending-appressed branches and pedicels scabridulous to scabrid, the long-pedicellate spikelets borne nearly to the base of the branches. Glumes to 3.5 mm. long, acute, glabrous or sometimes faintly scabridulous, the keel finely scabridulous. Lemma to nearly 2 mm. long, bidentate, the geniculate awn to 4 mm. long, inserted below the middle of the lemma and much exceeding the glumes; palea absent or very minute. LA PAZ: MURILLO: Unduavi, *Buchtien* 2581 (Hitchcock).

10. *A. tolucensis* HBK. Nov. Gen. & Sp. 1: 135 (1816). Erect or spreading, to 6 dm. tall. Leaf-sheaths glabrous, the ligule to 5 mm. long, acute, glabrous; blades flat to involute, to 2 mm. wide, scabridulous above and beneath. Panicle narrow, to 15 cm. long, dense, interrupted below, more or less spicate in appearance, rachis and branches glabrous to scabridulous, the pedicels scabridulous. Glumes 2.5-3 mm. long, acute, glabrous to scantily scabridulous, the keel scabridulous. Lemma 1.5 mm. long, bidentate, the straight awn about 2.5 mm. long, inserted at or above the middle of the lemma and much exceeding the glumes (awns sometimes absent); palea absent. LA PAZ: SUR YUNGAS: San Felipe, 2800 m., *Hitchcock* 22600 (GH).

39. *Alopecurus* L.

See Parodi in Revist. Fac. Agron. Vet. Buenos Aires, 7: 345-369 (1931).

Erect or decumbent perennials or annuals, 50 cm. to 1 m. high. Leaf-blades flat, to 6 mm. wide, glabrous beneath, scabrid above, the uppermost sometimes equaling or slightly exceeding the inflorescence. Inflorescence a condensed panicle, spicate in appearance. Spikelets 1-flowered, strongly flattened, disarticulation below the equal glumes. Lemmas about as long as the glumes, awned; palea lacking.

Awns nearly 5 mm. long; inflorescence to 3 cm. long, nearly 1 cm. wide. 1. *A. bracteatus*.

Awns 1 mm. long; inflorescence about 5 cm. long, about 4 mm. wide. 2. *A. aequalis*.

1. ***Alopecurus bracteatus*** Phil. in Anal. Univ. Chile, **94**: 6 (1896). Perennial. Spikelets 3-4 mm. long. Glumes 3-4 mm. long, the keel long-ciliate, the hairs up to 1.5 mm. long, the 2 lateral veins silky-villous. Lemmas 3-3.5 mm. long, the upper margins ciliolate, otherwise glabrous, the awn inserted well below the middle of the lemma. LA PAZ: LARECAJA: vic. Sorata; Alto de Ticonguaya, 4100 m., *Mandon* 1244 (GH); MURILLO: La Paz, 3750 m., *Buchtien* 431 (GH), 502 (GH), 861 (GH); Pelaya, 4000 m., *Hitchcock* 22585 (GH).

2. ***A. aequalis*** Sobol. Fl. Petrop. 16 (1799). Annual. Spikelets about 2.5 mm. long. Glumes about 2 mm. long, the keel ciliolate but not densely long-silky. Lemmas 2.5 mm. long, the awn about 1 mm. long, hardly or not at all exerted from the glumes, inserted near the apex of the lemma. LA PAZ: MURILLO: vic. La Paz, 5000 m., *Mandon* 1243 (GH).

Alopecurus Hitchcockii L. R. Parodi in Revist. Fac. Agron. Vet. Buenos Aires, **7**: 366 (1931). Described as having the inflorescence 4 cm. long, 5-6 mm. wide. Spikelets 2.5 mm. long. Lemma-awn 1.5 mm. long, inserted at 1/3 the length of the lemma, not, or only very slightly, exceeding the glumes.

From the description, this seems unduly close to ***A. aequalis***. It probably should not be maintained as distinct.

40. **Polypogon** Desf.

Perennial, in wet or damp habitats, to 1 m. high, leaf-blades flat. Inflorescence a narrow, dense, interrupted panicle, the 1-flowered spikelets disarticulating below the equal, awned glumes; lemma shorter than the glumes, thin-textured, usually awned, the awn inserted below the apex.

Glumes gradually attenuate into the awns, about 3 mm. long.

..... 1. *P. elongatus*.

Glumes abruptly obtuse, not narrowed into the awns, about 2 mm. long. 2. *P. interruptus*.

1. ***Polypogon elongatus*** HBK. Nov. Gen. & Sp. **1**: 134 (1816). Awns 1-1.5 mm. long, glumes scabrid-puberulent. Lemma 2 mm. long, the apex 2-4-toothed, the awn about 2 mm. long. LA PAZ: LARECAJA:

vic. Sorata, *Mandon* 1294 (GH); SUR YUNGAS: San Felipe, 2800 m., *Hitchcock* 22599 (GH).

2. *P. interruptus* HBK. No. Gen. & Sp. 1: 134 (1816). *P. lutosus* of the Catalogue. Awns 2.5-3 mm. long, glumes, especially the first, densely scabrid-puberulent. Lemma about 1 mm. long, apex toothed, awn about 2.5-3 mm. long. LA PAZ: MURILLO: cañon of Río de La Paz, 3355 m., *Shepard* 160 (GH); La Paz, 3300 m., *Rusby* 40 (GH), *Bang* 47 (GH), 3650 m., *Buchtien* 169 (GH), 238 (GH). COCHABAMBA: CERCADO: foothills of Mt. Tunari, 3400 m., *Steinbach* 9768 (GH); Valle de Cochabamba, *Steinbach* 8773 (GH), 8789 (GH); CHAPARE: Sacaba, 2900 m., *Steinbach s.m.* (GH); MIZQUE: Vilavila, 2600 m., *Eyerdam* 25321 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 206 (GH).

41. *Lycurus* HBK.

Lycurus phleoides HBK. Nov. Gen. & Sp. 1: 142 (1816). Perennial, somewhat caespitose, to 3 dm. high. Leaves mostly basal, crowded, the sheaths puberulent to scabrid. the short flat blades scabridulous above and beneath, scabrid-ciliate. Inflorescence a terminal dense panicle, spicate in appearance, to 5 cm. long, the branchlets and pedicels scabridulous. Spikelets 1-flowered, paired, 1 spikelet perfect, the other staminate or sterile, the pair falling as a unit, disarticulation below the glumes. Glumes about equal, or the second longer than the first, 1.5-2 mm. long, 2-awned, the awns to 6 mm. long, the keels scabrid-ciliolate. Lemmas to 4 mm. long with a 3 mm. straight awn, 3-nerved, the margins villous-ciliate on the lower half. Palea as long as the lemma, villous on the keels. LA PAZ: MURILLO: Capi, *Bang* 762 (GH). COCHABAMBA: CERCADO: west of Cochabamba, *Hitchcock* 22822 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 204a (GH).

42. *Muhlenbergia* Schreb.

See Parodi in *Physis*, 9: 205-222 (1928).

Annual or perennial, from dwarf plants a few centimeters high to about 1 m. high. Leaf-blades flat to involute. Inflorescence a racemose panicle, from dense and spicate to diffuse. Spikelets 1-flowered (2-3-flowered in one species), disarticulation above the awnless glumes. Lemma firm-textured, awned, the awn terminal, or very shortly cuspidate; palea similar to lemma and about as long, awnless.

- a. Second glume deeply tridentate. 1. *M. peruviana*.
- a. Second glume entire.
 - b. Panicle spicate in appearance. 7. *M. angustata*.
 - b. Panicle not spicate.
 - c. Panicle open to diffuse.
 - d. Lemma to 1.5 mm. long, awned, the awn to 5 mm. long. 3. *M. tenuissima*.

- d. Lemma to 2 mm. long, awnless, but shortly cuspidate.
..... 4. *M. asperifolia*.
- c. Panicle narrow.
 - e. Lemma awnless.
 - f. Leaf-blades flat; rhizome absent. 5. *M. ligularis*.
 - f. Leaf-blades involute; slender scaly rhizome present.
..... 6. *M. fastigiata*.
 - e. Lemma awned.
 - g. Awn over 1 cm. long.
 - h. Lemma 2.5-3 mm. long. 2. *M. quitensis*.
 - h. Lemma to 6-7 mm. long. 9. *M. rigida*.
 - g. Awn 3-4 mm. long. 8. *M. Holwayorum*.

1. *Muhlenbergia peruviana* (Beauv.) Steud. Nomencl. (ed. 2) 1: 41 (1840). *M. Herzogiana* Henrard in Meded. Rijks Herb. Leiden, no. 40: 58 (1921). Caespitose annual, 2-20 cm. high. Leaf-sheaths glabrous, ligule to 2 mm. long, acute to subobtuse; blades involute, very short, glabrous. Panicle to 2 cm. long, narrow, rather dense, rachis, branches and pedicels scabridulous. First glume entire, acute, to 1.5 mm. long; second glume to 2.25 mm. long, deeply tridentate. Lemma to 2.25 mm. long, scabridulous to pubescent, slightly bidentate, the straight or flexuose awn to 4 mm. long (rarely to 1.5 cm.); palea nearly as long as the lemma, sparsely pubescent. LA PAZ: MURILLO: La Paz, 4100 m., *Buchtien* 72 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 196 (GH); LINARES: Lagunillas, 3800 m., *Cárdenas* 483 in part (GH; originally entangled in a *Stevia*, no. 483). COCHABAMBA: CERCADO: Mt. Tunari, 3800 m., *Steinbach* 9849 (GH). TARIJA: CERCADO (?): Cuesta San Anaton, 3000 m., *Fiebrig* 3277 (GH).

2. *M. quitensis* (HBK.) Hitchc. in Contrib. U. S. Nat. Herb. 17: 292 (1913). Annual, 3-9 dm. high. Leaf-sheaths slightly scabridulous, the ligule to 4 mm. long; blades flat or involute, scabridulous, short (to 5 cm.), 2 mm. wide. Inflorescence narrow but loose, interrupted, to 2 dm. long, the primary branches bearing spikelets almost to the base. First glume to 2 mm. long, acute; second glume to 2.5-3 mm. long, entire, subulate-aristate. Lemma about 2.5-3 mm. long, subbidentate, the awn to 2 cm. long; palea pubescent at the base. Without locality: *Bang* 947 (Hitchcock).

3. *M. tenuissima* (Presl) Kunth, Rév. Gram. 1: suppl. XVI (1830). Delicate annual, to 2 dm. tall, occasionally taller. Leaf-sheaths glabrous to puberulous, the ligule to 2 mm. long, the apex rounded to subacute; blades short, flat, about 1 mm. wide, sparsely pubescent above and beneath, or almost glabrous. Panicle 10 cm. long, open, the primary branches apparently secund on occasion, rachis, branches and pedicels mostly glabrous. First glume to 1 mm. long, acute; second glume to 1.5 mm. long, long-acute or acuminate. Lemma (excluding awn) 1.5 mm. long, scabridulous, subbidentate, the straight awn to 5 mm. long; palea as long as lemma, somewhat puberulent at

base. LA PAZ: SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22622 (GH). COCHABAMBA: TARATA: Anzaldo, *Cárdenas* 2477 (GH).

4. *M. asperifolia* (Nees & Meyen) Parodi in *Physis*, 9: 210 (1928). Perennial, decumbent, to 4 dm. tall, with creeping rhizomes. Leaf-sheaths finely scabridulous to glabrous, the ligule 1-2 mm. long, apex rounded, ciliate or fimbriate-denticulate; blades short, flat, to 1.5 mm. wide, not falcate, scabridulous above and beneath. Panicle open, very diffuse, the primary branches rebranched, the branchlets bearing solitary long-pedicellate spikelets at the ends, branchlets and pedicels sparsely to rather densely scabridulous. Spikelets often 2-flowered, rarely 3-flowered, the florets distant on a glabrous rachilla. First glume to 1.75 mm. long, acute, somewhat scabridulous, especially on the keel; second glume to 2.25 mm. long, scabrid on the keel, the apex narrowly subtruncate, the midrib excurrent as a short scabridulous cusp. Lemma dark purple, at least in part, to 2 mm. long, slightly bidentate, the cusp less than 0.5 mm. long; palea as long as the lemma, bidentate, each tooth cuspidate. POTOSÍ: SUR CHICHAS: Oploca, *Hitchcock* 22891 (GH).

5. *M. ligularis* (Hack.) Hitchc. in *Contrib. U. S. Nat. Herb.* 24: 388 (1927). Decumbent tufted perennial, not rhizomatous, culms to 10 cm. high. Leaf-sheaths glabrous to finely papillate-scabridulous, the ligule to 4 mm. long, more or less acute; blades flat, to 2 mm. wide, rarely over 2 cm. long, finely papillate-scabridulous above and beneath. Panicle short, hardly 4 cm. long, narrow, few-branched, rachis, branches and short pedicels finely scabridulous. Glumes subequal, about 1 mm. long, the apex usually rounded, occasionally truncately subacute, the keel not prominent. Lemma to 2 mm. long, callus glabrous, finely scabridulous above, the midrib slightly excurrent as a cusp 0.2 mm. long; palea as long as the lemma. LA PAZ: MURILLO: vic. La Paz, 3300 m., *Bang* 109 (GH); LARECAJA: Millipaya, 3700 m., *Mandon* 1286 (GH).

6. *M. fastigiata* (Presl) Henrard in *Meded. Rijks Herb. Leiden*, no. 40: 59 (1921). Tufted creeping perennial, a few centimeters high, with spreading, slender, scaly rhizomes. Leaf-sheaths finely papillate, ligule about 1-1.5 mm. long, acute; blades involute, falcate, seldom over 1 cm. long, finely papillate. Panicle to 1 cm. long, narrow, few-flowered, rachis, branches and short pedicels finely papillate to scabridulous. Glumes subequal, slightly over 1 mm. long, acute, keel prominent, scabridulous. Lemma to 2.5 mm. long, acute, the apex with a cusp about 0.2-0.4 mm. long; palea about as long as the lemma, hardly cuspidate. LA PAZ: MURILLO: La Paz, 4100 m., *Buchtien* (GH). TARIJA: AVILES: Puna Patanca, 3700 m., *Fiebrig* 2633 (GH).

7. *M. angustata* (Presl) Kunth, *Rév. Gram.* 1: suppl. XVI (1830). Caespitose perennial, to 8 dm. tall. Leaf-sheaths scabridulous, the ligule to 1.1 cm. long, rounded to acute at the apex; blades long, folded to involute, densely scabridulous. Panicle dense, spicate in

appearance, to 15 cm. long, rachis, branches and short pedicels densely scabrid to densely short-hispid. Glumes equal or subequal, to 6-7 mm. long, acute, scabridulous. Lemma as long as the glumes, scabridulous, the straight awn to 3 mm. long; palea slightly shorter than the lemma, scabridulous, acute to subbidentate. LA PAZ: LARECAJA: near Millipaya, 3600 m., *Mandon* 1279 (GH). TARIJA: CERCADO: Calderillo, *Fiebrig* 3173 (GH).

8. **M. Holwayorum** Hitchc. in Contrib. U. S. Nat. Herb. 24: 389 (1927). Caespitose perennial to 6 dm. high. Leaf-sheaths glabrous, the ligule to 5 mm. long; blades flat to involute, to 3 mm. wide, scabridulous. Panicle narrow, to 2 dm. long, the rachis, appressed branches and pedicels scabridulous. Glumes subequal, about 1.5 mm. long, acute. Lemma to 3-4 mm. long, the awn to 3-4 mm. long; palea as long as the lemma. LA PAZ: LARECAJA: Sorata, *Holway & Holway* 530 (US; type).

9. **M. rigida** (HBK.) Kunth, Rév. Gram. 1: 63 (1829). *M. phragmitoides* of the Catalogue. Caespitose perennial, to 8 dm. tall. Leaf-sheaths finely puberulent to scabridulous, the ligule to 4 mm. long, apically dentate; blades firm, involute, scabridulous (at least above), acute. Panicle narrow, lax, not spicate in appearance, to 3 dm. long, the rachis, ascending branches and long pedicels scabridulous. Glumes subequal, to 2 mm. long, acute. Lemma to 6-7 mm. long, scabridulous, the awn to 1.5 cm. long; palea slightly shorter than the lemma. LA PAZ: MURILLO: Obrajes, 3350 m., *Buchtien* 819 (GH); LARECAJA: San Pedro, 2600-2700 m., *Mandon* 1280 (GH).

43. **Triniochloa** Hitchc.

Triniochloa stipoides (HBK.) Hitchc. in Contrib. U. S. Nat. Herb. 17: 303 (1913). Perennial, to 1 m. high. Leaf-sheaths and blades puberulent, the blades very narrow and sometimes involute. Inflorescence a lax, few-flowered panicle, to 2 dm. long, the branches scabridulous. Spikelets 1-flowered, disarticulation above the glumes, to 1.2 cm. long (excluding the awn). Glumes equal, thin-textured, 2-3 mm. long, acute, 1-nerved, the keels scabridulous. Lemma nearly terete, rather indurate, to 1.2 cm. long, scabrid-puberulent on the upper portion, bidentate, the dorsal geniculate awn to nearly 2 cm. long, the lower half loosely twisted, the callus densely villous with hairs to 1.5 mm. long. Palea as long as the lemma and as firm-textured, deeply bidentate, the keels scabridulous. LA PAZ: NOR YUNGAS: Unduavi, 3800 m., *Buchtien* 4172 (GH).

44. **Aciachne** Benth.

See Chase in Journ. Wash. Acad. Sci. 14: 364-366 (1924).

Aciachne pulvinata Benth. in Hook. Ic. Pl. 4: 44, t. 1362 (1881). Low-growing, less than 10 cm. high, densely caespitose perennial, in

wide-spread clumps. Leaf-blades involute, glabrous, falcate, pungent, about 1 cm. long. Inflorescence a single 1-flowered perfect spikelet, terminal on a solitary peduncle, hardly, or not at all, raised above the leaves, disarticulation above the glumes. Glumes equal, about 2 mm. long, more or less indurate, produced into a long, sharp awn-like point. Palea much shorter than the lemma and more or less enclosed by it, the rounded apex bifid. LA PAZ: LARECAJA: vic. Sorata; Chilcani, 3600-4200 m., *Mandon* 1287 (GH). COCHABAMBA: CHAPARE: Cumbre de San Benito, 3600 m., *Steinbach* 9888 (GH). Locality uncertain: *Fiebrig* 3571 (GH), *Bang* 1843 (GH).

45. *Sporobolus* R. Br.

See Parodi in *Revist. Fac. Agron. Vet. Buenos Aires*, 6: 115-168 (1928).

Annual or perennial. Ligule obsolete, reduced to a semi-lunate line of hairs. Leaf-blades involute or flat. Inflorescence a panicle, open or spicate in appearance, often subpyramidal. Spikelets 1-flowered, disarticulation above the unequal glumes. Lemma and palea similar in appearance, the palea frequently splitting. Caryopsis turbinate-pyriform to oblong-ovoid, readily shed.

a. Primary branches not in whorls.

b. Spikelets hardly 1 mm. long; panicle very open and diffuse. 1. *S. tenuissimus*.

b. Spikelets 2-3 mm. long.

c. Panicle narrow, spicate in appearance; spikelets to 3 mm. long. 4. *S. Poirerii*.

c. Panicle more open, not spicate; spikelets 2 mm. long, or less. 5. *S. indicus*.

a. Primary panicle-branches in whorls.

d. Spikelets about 2 mm. long. 2. *S. argutus*.

d. Spikelets 3-4 mm. long. 3. *S. aeneus*.

1. *Sporobolus tenuissimus* (Mart. ex Schrank) O. Ktze. *Rev. Gen.* 3(2): 369 (1898). Annual, delicate, to 7 dm. high, glabrous, the culms compressed. Leaf-blades linear, to 3 mm. wide, sometimes equaling the inflorescence. Panicle to 3.5 dm. long, narrow, very open, the primary branches not whorled, branches ascending to spreading, pedicels delicate, long. Spikelets 1 mm. long, or less. First glume to 0.3 mm. long, narrowly linear; second glume 0.6 mm. long, narrowly deltoid. Lemma ovate to obovate, 1 mm. long or less, acute; palea as long, broader, the apex truncate to obtusely rounded. Caryopsis turbinate-pyriform, broadest at the apex or very near it. SANTA CRUZ: SARA: between the Río Cuchi and Río Piray, *Herzog* 1446 (Hitchcock).

2. *S. argutus* (Nees) Kunth, *Enum. Pl.* 1: 215 (1833). Spreading to suberect perennial, to 5 dm. tall. Leaf-sheaths glabrous; blades glabrous, the margins scabrid, linear, to 7-8 cm. long and 5 mm. wide,

flat to folded or subinvolute. Panicle to 10 cm. long, narrow, narrowly pyramidal at maturity, the primary branches in whorls, rachis, branches and pedicels glabrous. Spikelets about 2 mm. long. First glume 0.5 mm. long, oblong-ovate, subobtuse; second glume 1.75 mm. long, acute. Lemma 1.5 mm. long, acute; palea shorter and broader. Caryopsis oblong-ovoid, broadest at the middle. LA PAZ: MURILLO: La Paz, 3300 m., *Bang* 79 (GH).

3. *S. aeneus* (Trin.) Kunth, Rév. Gram. 1: suppl. XVII (1830). Densely caespitose perennial, to 6 dm. tall. Leaf-sheaths glabrous, the margins ciliate; blades long, narrow, folded or involute, pilose at the base on the adaxial surface, the margins ciliate. Panicle subpyramidal, narrow, to 3 dm. long, primary branches in distant whorls, floriferous nearly to the base, rachis, branches and pedicels glabrous. Spikelets 3-4 mm. long. First glume about 1.5 mm. long, lance-linear; second glume as long as the spikelet, 1-nerved. Lemma to 3-4 mm. long, lanceolate, acute, 3-nerved; palea as long as lemma. Caryopsis oblong-ovoid, broadest at the middle. LA PAZ: LARECAJA: Hacienda Casana, *Buchtien* 7147 (Hitchcock).

4. *S. Poiretii* (Roem. & Schult.) Hitchc. in *Bartonia*, 14: 32 (1932). *S. Berteroanus* of the Catalogue. Perennial, to 1 m. tall. Leaves glabrous, the blades sometimes equaling the inflorescence, flat below to involute above, to 5 mm. wide at the base. Inflorescence to 4 dm. long, usually much shorter, spicate in appearance, the primary branches not in whorls, rachis glabrous, branches and pedicels usually glabrous, sometimes sparsely scabridulous. Spikelets to 3 mm. long. First glume 0.5-1 mm. long, oblong-ovate, the apex truncate and erosulous; second glume 1.5 mm. long, acute, the upper margins erose. Lemma nearly 3 mm. long, acute to subobtuse; palea similar, but slightly shorter. Caryopsis turbinate-pyriform, broadest near or at the apex. LA PAZ: LARECAJA: Sorata, *Mandon* 1285 (GH); MURILLO: La Paz, 3700 m., *Buchtien* 179 (GH); NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 4187 (GH). COCHABAMBA: CHAPARE: Sacaba, 2900 m., *Steinbach* 8808 (GH); CERCADO: Mollemolle, 2800 m., *Steinbach* 4054 (GH). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5148 (GH).

5. *S. indicus* (L.) R. Br. Prodr. Fl. Nov. Holl. 1: 170 (1810). Perennial, to 8 dm. tall. Leaves glabrous, the blades chiefly involute, to 2 mm. wide at the base, shorter than the inflorescence. Panicle interrupted at the base, branches not whorled, moderately long and ascending to spreading, rachis, branches and pedicels glabrous to sparsely scabridulous. Spikelets 2 mm. long or less. First glume less than 0.5 mm. long, obtuse to truncate and erosulous; second glume somewhat less than 1 mm. long, acute or subacute. Lemma about 2 mm. long, acute; palea similar, usually somewhat shorter. SANTA CRUZ: ICHILO: Río Palometillas, 400 m., *Steinbach* 7933 (GH); SARA:

Buenavista, 450-500 m., *Steinbach* 6701 (GH), 6843 (GH), 6844 (GH), 6852 (GH), 6854 (GH).

Sporobolus eximius (Nees) Ekm. was included among the Bolivian species by Hitchcock, on the basis of a Fiebrig collection from Toldos. This locality is in Argentina. I have seen no Bolivian material of the species.

46. *Nassella* (Trin.) E. Desv.

See Parodi in *Darwiniana*, 7: 369-395 (1947).

Perennials, often caespitose. Leaf-blades flat or convolute. Inflorescence a panicle, the 1-flowered spikelets disarticulating above the glumes. Glumes equal or unequal, rather thin, mostly hyaline. Lemma obliquely obovoid, gibbous toward the apex, often somewhat apiculate or mucronulate, enclosing the short membranous palea. Awn excentrically attached, caducous.

a. Glumes equal, or if unequal, not markedly so; lemma villous, callus villous.

b. Lower portion of awn villous; callus acute. 1. *N. Asplundii*.

b. Lower portion of awn scabrous; callus obtuse. 2. *N. pubiflora*.

a. Glumes markedly unequal; lemma glabrous or nearly so; callus glabrous or with a few short hairs. 3. *N. Meyeniana*.

1. *Nassella Asplundii* Hitchc. in *Contrib. U. S. Nat. Herb.* 24: 394 (1927). Caespitose, to 6 dm. tall. Leaf-sheaths glabrous or sparsely villous at the apex; blades involute, to 5 cm. long (occasionally longer). Panicle to 1.5 dm. long, open, the capillary branches naked below, axis and branches glabrous, pedicels scabrous-hirsutulous. Glumes to 4 mm. long, 3-nerved, the first glume ciliate on the keel. Lemma densely villous, 2.5 mm. long, the oblique apex unilaterally apiculate. Awn to 1.5 cm. long. POTOSÍ: Porco: Uyuni, 3500 m., *Asplund* 6548 (US; type).

2. *N. pubiflora* (Trin. & Rupr.) Desv. in *Gay, Fl. Chile*, 6: 264 (1853). *N. flaccidula* Hack. and *N. flaccidula* var. *humilior* Hack. in *Fedde, Rep. Sp. Nov.* 6: 155 (1908). *N. deltoidea* Hack. in *Fedde, Rep. Sp. Nov.* 11: 23 (1912). ? *Stipa tiraquensis* O. Ktze. *Rev. Gen.* 3(2): 373 (1898). *Stipa Pflanzii* Mez in *Fedde, Rep. Sp. Nov.* 17: 206 (1921). Caespitose, 5-9 dm. tall. Leaf-sheaths glabrous to scabrous; blades flat or subconvolute, glabrous, to 20 cm. long. Panicle to 2 dm. long, the lower branches naked on the basal third, axis scabridulous, branches and pedicels puberulent to shortly pubescent. Glumes 3.5-5 mm. long, 3-nerved, the first glume sparsely ciliate on the keel. Lemma villous, 2-2.4 mm. long, the obtuse callus villous; awn geniculate, to 1.5 cm. long, the base scabrous. LA PAZ: LARECAJA: vic. Sorata; Puquesani, 2700-3000 m., *Mandon* 1270 (GH); Catarguata, 3000 m., *Mandon* 1270 bis (GH; in part); MURILLO: La Paz, *Buchtien* 8541

(GH), 9309 (GH); Cerro del Calvario, 3800 m., *Buchtien* 145 (Hitchcock); Palca, 3700 m., *Hitchcock* 22579 (GH).

3. *N. Meyeniana* (Trin. & Rupr.) Parodi in *Darwiniana*, 7: 379 ((1947)). *N. corniculata* Hack. in Fedde, Rep. Sp. Nov. 5: 155 (1908). Caespitose, to 6 dm. tall. Leaf-sheaths glabrous or somewhat pubescent at the apex; blades flat or subconvolute, to 20 cm. long, glabrous or dorsally pubescent. Panicle narrow, somewhat interrupted, to 25 cm. long, branchlets covered by spikelets to the base, axis and branchlets glabrous, the pedicels hispidulous on the angles. Glumes glabrous, markedly unequal, the first glume 4-4.5 mm. long, the second glume 3.5-4 mm. long. Lemma 1.8-2.2 mm. long, glabrous, shining, the obtuse callus glabrous or with a few short hairs, awn 1-1.5 cm. long, weakly or not at all geniculate. LA PAZ: MURILLO: La Paz, *Bang* 40 (GH); La Paz, 3700 m., *Buchtien* 366 (GH).

47. *Piptochaetium* Presl

See Parodi in *Revist. Mus. La Plata* (n. s.) Bot. 6: 213-310 (1944).

Piptochaetium panicoides (Lam.) E. Desv. in Gay, *Fl. Chile*, 6: 270 (1853). *P. setifolium* and *P. tuberculatum* of the Catalogue. Caespitose perennial to 4 dm. tall. Leaves mostly basal, shorter than the inflorescence, the glabrous involute blades to 15 cm. long and 0.5 mm. wide. Inflorescence a terminal racemose panicle, to 1 dm. long, few-flowered, the rachis, branches and pedicels puberulent-scabridulous. Spikelets 1-flowered, disarticulation above the glumes. Glumes subequal, 3.5-4 mm. long, acuminate, several-nerved, glabrous. Lemma more or less D-shaped, to 2.5 mm. long, thick, firm-textured, surrounding the caryopsis and almost concealing the palea, finely striate, with a short apical collar strongly oblique at the summit, bearing a geniculate, loosely twisted excentric awn to 1 cm. long. Palea coriaceous, with 2 keels. (Department and province unknown): Alto de Cuchilla, 2600 m., *Troll* 839 (Parodi).

P. panicoides f. *subpapillosum* (Hack.) Parodi in *Revist. Mus. La Plata* (n. s.) Bot. 6: 302 (1944). A form with the lemma more or less papillose-tuberculate. LA PAZ: LARECAJA: vic. Sorata; Munaypata, 2650-2900 m., *Mandon* 1274 (GH).

48. *Stipa* L.

See Hitchcock in *Contrib. U. S. Nat. Herb.* 24: 263-289 (1925).

Perennial. Leaf-blades mostly involute, sometimes flat. Inflorescence a panicle. Spikelets 1-flowered, disarticulation above the glumes; callus sharply pointed. Glumes hyaline-membranous. Lemma indurate, mostly fusiform, with a terminal twisted awn.

- a. Glumes unequal, the outer much longer than the inner.
- b. Longest glumes 1 cm. or more in length.
- c. Lemma with an apical crown.

- d. Lemma about 8 mm. long. 9. *S. Neesiana*.
- d. Lemma about 3 mm. long. 11. *S. depauperata*.
- c. Lemma without an apical crown. 18. *S. Holwayi*.
- b. Longest glumes to 7 mm. long. 3. *S. pampagrandensis*.
- a. Glumes equal or subequal, but the outer not much longer than the inner.
- e. Longest glumes about 1 cm. or more in length.
- f. Lemma with an apical crown.
 - g. Lemma 5-6 mm. long, villous below and nearly to apex; crown conspicuous, ciliate with short, thick, hispid hairs. 8. *S. mucronata*.
 - g. Lemma 4 mm. long, appressed-villous, crown short. 12. *S. brachyphylla*.
- f. Lemma without an apical crown.
 - h. Awn plumose on one segment.
 - i. Lemma to 9 mm. long; awn plumose on basal segment only. 1. *S. speciosa*.
 - i. Lemma to 5 mm. long; awn plumose on terminal segment only. 2. *S. plumosa*.
 - h. Awn not plumose, but sometimes pubescent or subvillous.
 - j. Lemma to 4 mm. long, villous, the apical hairs to 3 mm. long. 6. *S. nardoides*.
 - j. Lemma to 8 mm. long, sparsely villous, or glabrous, the apical hairs, if any, short. 14. *S. curviseta*.
- e. Longest glumes less than 1 cm. long; lemma lacking an apical crown.
- k. Awn straight or flexuose, but not geniculate.
 - l. Apex of lemma with a dense ring of hairs 3-4 mm. long; lemma fusiform or subfusiform.
 - m. Lemma glabrous or sparsely villous at base or apex. 7. *S. Hans-meyeri*.
 - m. Lemma sparsely pubescent or short-villous.
 - n. Lemma to 3 mm. long. 4. *S. Ichu*.
 - n. Lemma to 4-5 mm. long. 5. *S. capilliseta*.
 - l. Apex of lemma without a dense ring of hairs.
 - o. Lemma-apex broad, truncate; awn slightly excentric. 19. *S. florulenta*.
 - o. Lemma-apex attenuate, not truncate; awn not excentric.
 - p. Glumes acute; lemma glabrous above, sparsely pubescent below. 16. *S. polyclada*.
 - p. Glumes more or less obtuse; lemma glabrous, save for a few short hairs near apex. 15. *S. obtusa*.
- k. Awn geniculate.
 - q. Lemma obovoid, apex truncate. 10. *S. inconspicua*.
 - q. Lemma narrowly ellipsoid to fusiform, apex attenuate.
 - r. Lemma 3 mm. long, sparsely villous. 13. *S. dasycarpa*.

- r. Lemma at least 4 mm. long.
- s. Plants to 2.5 dm. tall; lemma short-pilose. 17. *S. illimanica*.
- s. Plants to 4-6 dm. tall; lemma sparsely short-pilose. 20. *S. Trollii*.

1. *Stipa speciosa* Trin. & Rupr. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 5(1): 45 (1843). To 6 dm. tall, rigid, erect, the brown bases glabrous to pubescent. Leaves involute, acute to pungent, glabrous, or the margins loosely long-ciliate. Panicle rather dense, to 1 dm. long, the axis glabrous to scabrid to pubescent, the pedicels scabrid to pubescent and villous at the apex. Glumes thin, subequal or the outer shorter, long-acuminate, to 2.2 cm. long, 1-3-nerved, glabrous. Lemma to 9 mm. long, densely pubescent to villous. Awn to 6 cm. long, once-geniculate, twisted and plumose below the geniculation, glabrous above it. ORURO: POOPÓ: Pasña, *Buchtien* 1184 (US); PORCO: Uyuni, *Asplund* 6552 (US).

2. *S. plumosa* Trin. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 4(2): 37 (1836). Erect to straggling, somewhat woody, to 2 m. tall, the base leafless or covered with old, glabrous to pubescent leaf-sheaths. Leaf-blades involute or subinvolute, long-ciliate, acute. Panicle somewhat lax, narrow, to 2 dm. long, the axis and branchlets mostly glabrous, pedicels glabrous to scabrid and short-pubescent on the angles. Glumes thin, papery, long-acuminate, 3-nerved, sparsely villous, usually on the midrib, to 1.2 cm. long. Lemma to 5 mm. long, pubescent to short-villous, glabrous near the apex and with an apical ring of sparse stiff hairs. Awn strongly geniculate or curved, to 4 cm. long, the basal section twisted and pubescent to short-villous, the upper section plumose. SANTA CRUZ: VALLEGRANDE: Comarapa, *Herzog* 1885 (US). POTOSÍ: PORCO: Uyuni, *Asplund* 6563 (US).

3. *S. pampagrandensis* Speg. in Anal. Mus. Nac. Montevideo, 4: 158 (1910). To 10 dm. tall, erect, glabrous. Leaf-blades involute. Panicle narrow, lax to 2 dm. long, somewhat exceeding or nearly equaled by the leaf-blades, axis glabrous, pedicels scabrid. Glumes unequal, the outer much longer than the inner, to 7 mm. long, long-attenuate to almost aristate, thin, 3-nerved. Lemma more or less obovoid, glabrous, irregularly rugulose or papillate-striate, to 3 mm. long. Awn to 5 cm. long, geniculate or strongly curved, the lower portion loosely twisted and scabridulous, the upper portion straight and glabrous to minutely scabridulous. TARIJA: CERCADO: Junaca, *Fries* 1308 (US).

4. *S. Ichu* (Ruíz & Pav.) Kunth, Rév. Gram. 1: 60 (1829). Caespitose, erect, glabrous, to 1.5 m. high. Leaf-blades involute, pungent. Panicle to 4 dm. long, lax, rather narrow, often silvery in color, the axis glabrous, branchlets and pedicels finely scabridulous. Glumes subequal or equal, thin, papery, long-acute, to 8 mm. long. Lemma fusiform, to 3 mm. long, sparsely pubescent, with a dense apical ring of hairs to 3-4 mm. long. Awn to 1.7 cm. long, scabridulous, not

geniculate but somewhat flexuose, the basal portion loosely twisted. LA PAZ: LARECAJA: Río Challasuyos between Lojena and Illampú, 2650-3800 m., *Mandon* 1273 (GH); MURILLO: La Paz, 3750 m., *Buch-tien* 185 (GH); Palca, *Hitchcock* 22581 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 199 (GH), 205 (GH). COCHABAMBA: CHAPARE: Cuchicanchi, 3300 m., *Steinbach* 9632 (GH).

5. *S. capilliseta* Hitchc. in Contrib. U. S. Nat. Herb. 24: 271 (1925). Caespitose, glabrous, to 5 dm. tall. Leaf-blades about equaling the base of the inflorescence, pungent, involute. Panicle narrow, to 15 cm. long, axis, branches and pedicels scabrid. Glumes subequal, to 7 mm. long, hyaline, papery, obscurely 3-nerved, scabridulous near base and along midrib, long-acute. Lemma 4-5 mm. long, fusiform, sparsely pubescent to short-villous, especially below, the apex with denser hairs to 4 mm. long. Awn to 2 cm. long, scabridulous, not geniculate but the lower portion loosely twisted. POTOSÍ: NOR LIPEZ: Chiguana, 3700 m., *Asplund* 6566 (US; type).

6. *S. nardoides* (R. A. Phil.) Hack. ex Hitchc. in Contrib. U. S. Nat. Herb. 24: 271 (1925). Densely caespitose, to 4 dm. high. Leaf-sheaths short-pubescent, short-villous at the apex; blades short, involute, obtuse to subpungent. Panicle narrow, to 1 dm. long, axis, branches and pedicels puberulent to scabridulous. Glumes subequal, glabrous, to 1 cm. long, long-acute, obscurely 3-nerved, purplish, the margins and apex white-hyaline. Lemma to 4 mm. long, terete or subfusiform, densely short-villous, the longer apical hairs to 3 mm. long. Awn to 2 cm. long, geniculate, basal portion tightly twisted, somewhat puberulous, upper portion shortly puberulous. ORURO: PORCO: Uyuni, *Asplund* 6539 (US).

7. *S. Hans-meyeri* Pilger in Engler, Bot Jahrb. 56, Beibl. 123: 24 (1920). Caespitose, glabrous, to 5 dm. tall. Leaf-blades involute, pungent. Panicle dense, to 10 (-20) cm. long, purple or brownish-purple, axis, branches and pedicels scabridulous. Glumes equal or subequal, to 7 mm. long, long-acute, glabrous. Lemma subfusiform, to 3.5 mm. long, sparsely villous at base and apex, the apical ring of hairs dense and to 3 mm. long. Awn about 1 cm. long, curved but not strongly geniculate, the base puberulent, the upper portion finely scabridulous. LA PAZ: LARECAJA: inter Millipaya et Velatutini, 3700 m., *Mandon* 1272 bis (GH).

8. *S. mucronata* HBK. Nov. Gen. & Sp. 1: 225 (1816). Caespitose, to 10 dm. tall, erect or geniculate, mostly glabrous. Leaf-blades often about equaling the inflorescence, flat or somewhat folded, sparsely scabrid beneath, the margins coarsely ciliate. Panicle to 3 dm. long, lax, the axis glabrous, branches and pedicels somewhat puberulent-scabridulous. Glumes subequal, or the outer slightly longer, about 1 cm. long, long-acute, the midrib and margins often coarsely and sparsely hispid-ciliate. Lemma to 5-6 mm. long, subfusiform, villous below and nearly to the summit, the apex developed into a crown

terminated by short stiff hairs. Awn to 3 cm. long, twice bent, the lowest portion tightly twisted and pubescent, the central portion loosely twisted and scabridulous, the terminal portion straight and only minutely scabridulous. LA PAZ: MURILLO: La Paz, 3750 m., *Buchtien* 3692 (GH), 430 (GH); LARECAJA: vic. Sorata, 2600-2700 m., *Mandon* 1276 (GH). COCHABAMBA: CERCADO: Mollemolle, 2800 m., *Steinbach* 4056 (GH).

9. *S. Neesiana* Trin. & Rupr. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 5(1):27 (1843). To 10 dm. tall, caespitose, mostly glabrous, the nodes usually pubescent to villous. Leaf-blades flat to folded, scabridulous beneath, the margins hispid-ciliate. Panicle to 2 dm. long, axis glabrous, branches and pedicels scabridulous to hispidulous. Glumes somewhat unequal, the outer longer, to 1.5 cm. long, long-acute, the midribs often hispid. Lemma to 8 mm. long, pubescent to villous below, the upper portion glabrous, smooth to papillate-rugose, the apical crown often long. Awn twice-bent or twice-geniculate, to 1.5 cm. long, the lowest portion tightly twisted and pubescent, the central portion loosely twisted and puberulent, the terminal portion straight and puberulent to scabridulous. LA PAZ: LARECAJA: Sorata, *Rusby* 237 (US). COCHABAMBA: CERCADO: Cochabamba, *Holway* 328 (US).

Extreme forms of *S. Neesiana* and *S. mucronata* appear quite distinct, but enough intergradation occurs to make their specific distinctness appear somewhat questionable.

10. *S. inconspicua* Presl, Rel. Haenk. 1: 277 (1830). *Nassella flaccidula* Hack. in Fedde, Rep. Sp. Nov. 6: 154 (1908). Caespitose, to 4.5 dm. tall, glabrous. Leaf-blades flat or involute, the uppermost equaling or exceeding the inflorescence. Panicle to 10 cm. (occasionally to 18 cm.), narrow, the branches quite distant, axis and branches glabrous, branchlets and pedicels puberulent to scabridulous. Glumes subequal or the outer slightly longer, acute, several-veined, about 3.5 mm. long. Lemma more or less obovoid, 2.5-3 mm. long, sparsely pubescent. Awn to 1.5 cm. long, once-geniculate, scabridulous, the lower portion twisted, the upper portion straight. LA PAZ: MURILLO: La Paz, *Holway* 600 (US).

11. *S. depauperata* Pilger in Engler, Bot. Jahrb. 56, Beibl. 123: 23 (1920). Caespitose, spreading, to 5 dm. tall, mostly glabrous. Leaves short, the involute blades rarely equaling the base of the inflorescence. Panicle narrow, to 15 cm. long, brownish to purplish, axis glabrous, branchlets and pedicels from glabrous to pubescent. Glumes unequal, to 1 cm. long, long-acute, the midribs minutely scabridulous, otherwise glabrous. Lemma fusiform, to 3 mm. long, pubescent (sometimes sparsely so), the apical crown quite short. Awn to 1.5 cm. long, geniculate, the lower portion tightly twisted and short-pubescent, the upper portion straight and puberulent to scabridulous. LA PAZ: MURILLO: La Paz, *Holway* 492 (US).

12. *S. brachyphylla* Hitchc. in Contrib. U. S. Nat. Herb. 24: 275 (1925). Caespitose, to 4 dm. tall, glabrous. Leaves short, the blades involute, pungent, upper surface scabrid. Panicle lax, narrow, to 1 dm. long, axis and branches glabrous, branchlets and pedicels puberulent to short-hispid. Glumes somewhat unequal or subequal, to 1 cm. long, acute or acuminate, the midrib of outer glume often sparsely appressed-hispid. Lemma fusiform, about 4 mm. long, or a little longer, appressed-villous, the apical crown short. Awn to 2.5 cm. long, twice-geniculate, lowest portion tightly twisted and pubescent, central portion more loosely twisted and puberulent, upper portion straight, minutely puberulent to scabridulous. LA PAZ: MURILLO: La Paz, *Holway* 433 (US); OMASUYOS: Yumari, 3850 m., *Asplund* 6557 (US).

13. *S. dasycarpa* Hitchc. in Contrib. U. S. Nat. Herb. 24: 281 (1925). To 3-4 dm. tall. Leaf-blades involute, glabrous on the lower surface, puberulous on the upper surface. Panicle rather lax, to 1.5 dm. long. Glumes equal, 5 mm. long, acuminate. Lemma about 3 mm. long, fusiform, sparsely villous, apical crown lacking, callus 0.5 mm. long. Awn 2 cm. long, twice-geniculate, the lower 2 segments appressed-villous. POTOSÍ: NOR LIPEZ: Chiguana, *Asplund* 6562 (Hitchcock).

14. *S. curviseta* Hitchc. in Contrib. U. S. Nat. Herb. 24: 282 (1925). Caespitose, to 5 dm. tall. Leaf-blades involute, glabrous or scabridulous beneath, pubescent above. Panicle lax, to 2 dm. long, axis glabrous, branches and pedicels pubescent to scabrid. Glumes subequal, to 1.5 cm. long, long-acuminate. Lemma terete, to 8 mm. long, sparsely villous to glabrate, apical crown obscure, ciliate, callus to 3.5 mm. long. Awn to 7 cm. long, twice-geniculate, the lowest portion twisted and villous, the terminal segment flexuose, decreasingly villous toward the end. POTOSÍ: PORCO: Uyuni, 3700 m., *Asplund* 6551 (US; type); SUR CHICHAS: Atocha, 3700 m., *Asplund* 6550 (US), 6547 (US); NOR LIPEZ: Chiguana, 3700 m., *Asplund* 6554 (US).

15. *S. obtusa* (Nees & Mey.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 284 (1925). *S. boliviensis* Pilger in Engler, Bot. Jahrb. 56: 26 (1920). Caespitose, to 4 dm. high, glabrous. Leaf-blades involute, pungent, scabridulous, some equaling or exceeding the inflorescence-base. Panicle narrow, to 15 cm. long, axis, branches and pedicels scabridulous. Glumes equal or subequal, about 3 mm. long, broadly ovate, abruptly short-acute or subobtuse, the second glume often subtridentate. Lemma narrowly elliptic-fusiform, to 3 mm. long, glabrous save for a few short sparse hairs at or near the apex. Awn to 1 cm. long, not geniculate, not twisted, scabrid to scabridulous. LA PAZ: MURILLO: La Paz, 4100 m., *Buchtien* 184 (GH). COCHABAMBA: CERCADO: south side of Mt. Tunari, 3600 m., *Steinbach* 9786 (GH).

16. *S. polyclada* Hack. ex Stuck. in Anal. Mus. Nac. Buenos Aires, 21: 80 (1911). Straggling, the branches fascicled at the nodes. Leaf-blades involute to flat, pungent, short. Panicle lax, to 1 dm. long,

axis and branches glabrous (sometimes scabridulous), pedicels puberulent to scabridulous. Glumes hyaline, about 3 mm. long, acute, subequal. Lemma to 2.5 mm. long, narrowly ellipsoid, glabrous above, sparsely appressed-pubescent below, the apex attenuate. Awn to 2.5 cm. long, variously bent but not geniculate, scabridulous.

I have seen no Bolivian material on this species. In his treatment of the Andean grasses (1927) and his synopsis of South American *Stipa* (1925), Hitchcock cited *Asplund* 6563 as the basis for the inclusion of Bolivia in the range. The sheet of this number at Washington seems to me to be *Stipa plumosa*. Consequently, the occurrence of *Stipa polyclada* in Bolivia is problematical.

17. *S. illimanica* Hack. in Fedde, Rep. Sp. Nov. 11: 22 (1912). Caespitose, to 2.5 dm. tall. Leaf-blades flat or loosely involute, the margins scabrid. Panicle narrow, to 1.4 dm. long, axis glabrous. Glumes subequal, to 6 mm long, acute, 3-nerved. Lemma to 4-4.5 mm. long, short-pilose, the apex scabrid, apical crown lacking, callus short (0.5 mm.), pubescent. Awn to 3 cm. long, geniculate, the base loosely twisted and pubescent, the terminal portion puberulent to scabrid. LA PAZ: MURILLO: Cotaña, 2450 m., *Buchtien* 3134 (US; type-number).

18. *S. Holwayi* Hitchc. in Contrib. U. S. Nat. Herb. 24: 287 (1925). To 1 m. tall. Leaf-blades flat or involute, narrow, glabrous beneath, short-pubescent on upper surface. Inflorescence a narrow, lax panicle to 2.5 dm. long, axis glabrous, branches and pedicels shortly puberulous to hispid, especially near the apex of panicle. Glumes to 1.1 cm. long, unequal, the outer 1.5 mm. longer than the inner, 3-nerved, acuminate. Lemma to 5-6 mm. long, the callus to 1 or 1.5 mm. long and densely pubescent, fusiform, villous, the apex with an obscure crown. Awn to 4.5 cm. long, twice-geniculate, the 2 lower portions twisted and scabrid-pubescent, the terminal portion to 2-3 cm. long, flexuose, glabrous to scabridulous. ORURO: ABAROA: Challapata, 2900 m., *Asplund* 6546 (US). COCHABAMBA: CERCADO: Cochabamba, *Holway* 380 (US; type).

19. *S. florulenta* (Pilger) Parodi in Rev. Mus. La Plata (n. s.) Bot. 6: 307 (1944). *Oryzopsis florulenta* of the Catalogue. To 1 m. tall. Leaf-blades flat or somewhat involute, scabridulous. Panicle lax, to 2.5 dm. long (sometimes to 4 dm. ?), axis more or less glabrous, branches and pedicels hispid-scabridulous. Glumes subequal, to 4 mm. long, acute to acuminate, 3-nerved. Lemma about 3-4 mm. long, obovoid, apex broad and truncate without a crown or ciliation, sparsely pilose to almost glabrous. Awn to 2 cm. long, not geniculate, the scabridulous base somewhat loosely twisted, the remainder somewhat flexuose or straight. LA PAZ: LARECAJA: Catarguata, 3000 m., *Mandon* 1270 bis (GH; mixed with *Nassella pubiflora*).

20. *S. Trollii* Pilger in Notizbl. 11: 777 (1933). To 4-6 dm. tall. Leaf-blades somewhat involute, the upper surface scabridulous.

Panicle to 1.2 dm. long, the axis glabrous. Glumes 5-6 mm. long, lanceolate, the midrib somewhat excurrent. Lemma 4 mm. long, sparsely short-pilose. Awn to 1.5 cm. long, once-geniculate, glabrous. POTOSÍ: PORCO: Salasala-Tasnopalco, 3400 m., *Troll* 3374.

No material of this species has been seen. This description is adapted from the original description.

49. *Aristida* L.

See Caro in Kurtziana, 1: 123-206 (1961).

Annual or perennial. Leaf-blades flat or involute. Inflorescence a compact to lax panicle. Spikelets 1-flowered, disarticulation above the glumes, the callus sharply pointed. Glumes unequal to equal or subequal. Lemma terete to fusiform, with 3 apical awns, these free to the base or nearly so, or basally united in a short or long twisted column.

- a. Callus bidentate at tip. 4. *A. riparia*.
- a. Callus entire.
 - b. Glumes subequal or equal, or the outer longer than the inner.
 - c. Glumes very unequal, the outer about twice the length of the inner. 5. *A. mendocina*.
 - c. Glumes subequal or equal.
 - d. Leaf-blades involute. 6. *A. enodis*.
 - d. Leaf-blades flat (at least at base). 7. *A. circinalis*.
 - b. Glumes unequal, the outer shorter than the inner.
 - e. Lemma to 3 mm. long. 1. *A. capillacea*.
 - e. Lemma to 8-10 mm. long.
 - f. Lemma-awns united in a column 2-3 cm. long. 3. *A. implexa*.
 - f. Lemma-awns not united in a column.
 - g. Longest glumes to 7 mm. long. 2. *A. adscensionis*.
 - g. Longest glumes to 1.5 cm. long. 8. *A. laevis*.

1. *Aristida capillacea* Lam. Tabl. Encycl. 1: 156 (1791). *A. Mandoniana* Henr. in Meded. Rijks Herb. Leiden, no. 40: 55 (1921). Annual to 2 dm. high. Leaf-blades narrow, somewhat involute, scabridulous on upper surface, with a few scattered long hairs near the base. Panicle narrow but rather lax, to 8-10 cm. long, axis and branches glabrous, pedicels glabrous to puberulent. Glumes unequal, the outer shorter, to 4 mm. long, acute, glabrous, the prominent midrib scabridulous. Lemma to 3 mm. long. Awns united basally in a puberulent column, the free portions to 4-5 mm. long, puberulent to scabridulous. LA PAZ: SUR YUNGAS: Guanai, 1600 m., *Rusby* 208 (GH). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 6140 (GH).

2. *A. adscensionis* L. Sp. Pl. 82 (1753). Caespitose annual, glabrous, the culms branching from the lower nodes, to 3 dm. tall. Leaf-blades involute. Panicle to 1.5 dm. long, compact to spreading, axis, branches

and pedicels usually scabridulous. Glumes unequal, the outer shorter, to 7 mm. long, acute, the midrib scabrous. Lemma to 8 mm. long, the apex long-attenuate, the upper portion puberulent-scabrid. Awns not united basally into a column, to 2 cm. long, the central awn exceeding the laterals, markedly scabrous. COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22817 (GH). POTOSÍ: SUR CHICHAS: Villazón, 3500 m., *West* 6368 (GH). LA PAZ: MURILLO: Cotaña, 2450 m., *Buchtien* 208 (GH); Obrajes, 3300 m., *Buchtien* 140 (GH).

3. *A. implexa* Trin. in Mém. Acad. St. Pétersb. VI, Sci. Nat. 2(1): 48 (1836). Perennial, to 6 dm. tall. Leaf-blades flat or involute, the upper surface densely pilose near the base. Panicle to 2 dm. long, axis, branches and pedicels scabrid. Glumes unequal, the outer much shorter, to 2 cm. long, scabridulous, long-acute. Lemma to 8 mm. long, glabrous, the apex attenuate. Awns united basally into a twisted column to 2-3 cm. long, the free portions to 3-5 cm. long, the central awn longer than the laterals, scabridulous. SANTA CRUZ: SARA: Buenavista, *Steinbach* 5352 (GH), 7029 (GH).

4. *A. riparia* Trin. in Mém. Acad. St. Pétersb. VI, Sci. Nat. 2(1): 48 (1836). Perennial, caespitose, to 8 dm. high. Leaf-blades flat or involute, rather thick. Panicle to 1.5 dm. long, axis, branches and pedicels scabridulous. Glumes unequal or subequal, the outer longer, awned, to 1.4 cm. long (including the awn), scabridulous, the midrib of the outer glumes prominently so. Lemma to 6 mm. long, glabrous, the callus bidentate at the tip. Awns united basally in a twisted column to 1 cm. long, the free portions equal, to 2 cm. long, scabridulous. LA PAZ: SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22702 (GH).

5. *A. mendocina* R. A. Phil. in Anal. Univ. Chile, 36: 205 (1870). *A. inversa* Hack. in Fries in Ark. Bot. 8(8): 37 (1908). Perennial, caespitose, to 6 dm. high. Leaf-blades somewhat involute, scabridulous on the upper surface. Panicle lax, narrow, to 2 dm. long, axis, branches and pedicels scabridulous. Glumes very unequal, the first to 11 mm. long, midrib scabrid, the second to 5 mm. long, scabridulous, both glumes often shortly mucronate. Lemma terete to fusiform, somewhat scabridulous on the upper portion, to 9 mm. long. Awns free to the base or nearly so, the central awn to 3 cm. long, the laterals slightly shorter, scabridulous. SANTA CRUZ: SARA: Buenavista, *Steinbach* 1927 (GH).

I have followed Hitchcock in uniting *A. mendocina* and *A. inversa*, but Caro has shown some differences which may warrant at least varietal segregation.

6. *A. enodis* Hack. in Fedde, Rep. Sp. Nov. 11: 21 (1912). *A. Pflanzii* Mez in Fedde, Rep. Sp. Nov. 17: 151 (1921). ? *A. Asplundii* Henr. in Meded. Rijks Herb. Leiden, no 54: 42 (1926). Perennial, caespitose, to 4 (-5) dm. tall. Leaf-blades involute, often somewhat scabridulous. Panicle rather dense, often purple, to 10 cm. long.

Glumes equal or subequal, to 1 cm. long. scabrid to nearly glabrous, the scabrid midrib excurrent as a mucro. Lemma narrowly fusiform, to 1 cm. long, glabrous. Awns distinct to the base, to 3 cm. long, minutely scabridulous. LA PAZ: LARECAJA: prope Munaypata, 2700 m., *Mandon* 1277 (GH). SANTA CRUZ: SARA: Buenavista, 400 m., *Steinbach* 6807 (GH).

7. *A. circinalis* Lindm. in Sv. Vet. Akad. Handl. 34(6): 13 (1900). ? *A. Friesii* Henr. in Meded. Rijks Herb. Leiden, no. 54: 186 (1926). Perennial, caespitose, to 8 dm. tall. Leaf-blades long, flat near the base, becoming involute-filiform, glabrous. Panicle to 2 dm. long, axis, branches and pedicels usually glabrous. Glumes subequal or the outer longer, to 8 mm. long, glabrous, acute, or the midrib excurrent as a mucro. Lemma fusiform, to 7 mm. long, glabrous. Awns subequal, free to base, to 3 cm. long, minutely scabridulous. LA PAZ: SUR YUNGAS: Chulumani, *Hitchcock* 22711 (US).

8. *A. laevis* (Nees) Kunth, Enum. Pl. 1: 192 (1833). *A. complanata* of the Catalogue. *A. longiramea* var. *boliviana* Henr. in Meded. Rijks Herb. Leiden, no. 40: 56 (1921). Perennial, caespitose, to 7 dm. high. Leaf-blades flat, somewhat scabridulous. Panicle narrow, to 2.5 dm. long; axis, branches and pedicels scabridulous to scabrid. Glumes equal or subequal, the outer shorter, to 1.5 cm. long, aristate or mucronate, the midrib scabrid. Lemma tubular-fusiform, to 1 cm. long. Awns free to base, subequal, about 3 cm. long, scabridulous. SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5355 (GH).

50. *Tragus* Hall.

Tragus racemosus (L.) All. Fl. Pedem. 2: 241 (1785). Weedy annual. Stems somewhat geniculate, to 17 cm. high. Leaf-blades flat, lanceolate, to 2.5 cm. long, 6 mm. wide, acute, ciliate. Inflorescence a terminal spike, spikelets 1-flowered, paired, contiguous by flat faces, first glume absent, second glume about 3-4 mm. long, ovate, convex, the margin and three nerves bearing stout hooked spines, lemma and palea thin-textured. LA PAZ: LARECAJA: Sorata, *Mandon* 1268 (GH); NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 4176 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22649 (GH).

51. *Aegopogon* Humb. & Bonpl.

Annuals. Culms to 20 cm. long (rarely to 30 cm.), spreading or decumbent. Leaf-blades short, linear, flat, 1-2 mm. wide. Spikelets 1-flowered, pectinately arranged, in groups of 2 or 3, 1 perfect and nearly sessile, the 1 or 2 laterals pedicellate and either staminate or neuter, often purple; glumes narrow, half the length of the lemmas or less, scabridulous, with a rather short delicate awn, lemma with a long central awn and 2 shorter lateral awns, palea with 2 short awns.

Spikelets in groups of 3. 1. *Ae. cenchroides*.
 Spikelets in groups of 2. 2. *Ae. bryophilus*.

1. **Aegopogon cenchroides** Humb. & Bonpl. ex Willd. Sp. Pl. 4: 899 (1806). Leaf-blades scabridulous. Fertile spikelets (excluding the awns) about 3 mm. long. Central awn of lemma to 8 mm. long. LA PAZ: NOR YUNGAS: Unduavi, *Buchtien* 2578 (Hitchcock). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22820 (Hitchcock).

2. **Ae. bryophilus** Doell in Mart. Fl. Bras. 2(3): 239 (1880). *Ae. geminiflorus* var. *muticus* Pilger in Engler, Bot. Jahrb. 27: 25 (1899). *Ae. Fiebrigii* Mez in Fedde, Rep. Sp. Nov. 17: 145 (1921). Leaf-sheaths glabrous to scabridulous; blades scabridulous. Fertile spikelets (excluding the awns) about 3 mm. long. Central awn of lemma to 4-6 mm. long. LA PAZ: LARECAJA: Cerro del Iminapi, 2650-3100 m., *Mandon* 1296 (GH); Sorata, *Bang* 1307 (GH; type-number of *Ae. geminiflorus* var. *muticus*). COCHABAMBA: TOTORA: Vacas, 3500 m., *Steinbach* 3965 (GH). TARIJA: ARCE: Camacho, *Fiebrig* 2865 (Hitchcock).

52. *Leptochloa* Beauv.

Annual or perennial, the culms decumbent or erect, 3-8 dm. or even to 1 m. high, leaf-sheaths glabrous, glaucous, scabridulous or even sparsely pilose, blades flat, glabrous to sparsely pilose, rarely equaling or exceeding the mature inflorescence. Inflorescence a terminal, narrow to spreading panicle composed of few to many racemes. Spikelets usually many, few- to many-flowered, unilateral on the rachis, the rachilla disarticulating above the glumes, shortly pedicellate, appressed and somewhat imbricate; glumes unequal to nearly equal, 1-nerved; lemmas broad and notched at apex or acute, sometimes awned or mucronate, 3-nerved, glabrous, or pubescent between the lateral nerves and the margin, at least at the base, the uppermost lemma reduced.

- a. Spikelets at least 4 mm. long, usually to 7-9 mm. long.
 - b. Lemmas much exceeding the minutely ciliolate palea. 1. *L. uninervia*.
 - b. Lemmas about equal to, sometimes exceeded by, the distinctly ciliate palea. 2. *L. dubia*.
- a. Spikelets less than 4 mm. long, never to 7-9 mm. long.
 - c. Leaf-sheaths and blades glabrous, glaucous or rarely scabridulous, not pilose. 3. *L. virgata*.
 - c. Leaf-sheaths and blades not glaucous, sparsely long-pilose. 4. *L. domingensis*.

1. **Leptochloa uninervia** (Presl) Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 383 (1917). Annual. Leaf-sheaths glabrous, blades scabrid. Spikelets (4-) 7-8 mm. long. First glume to 2.5 mm. long, the central nerve carinate and scabrid, acute; second glume 3 mm. long, scabrid on the central nerve, acute, sometimes mucronulate.

Fertile lemmas about 4 mm. long, much exceeding the palea, palea minutely ciliate. COCHABAMBA: CERCADO: Cochabamba, 2560 m., *Steinbach* 8746 (GH).

2. *L. dubia* (HBK). Nees in *Sylog. Pl. Ratisb.* 1: 4 (1824). Perennial. Leaf-blades scabrid. Spikelets to 8-9 mm. long. First glume about 2.5 mm. long; second glume very broad, about 3 mm. long. Fertile lemma to 4-5 mm. long, obtuse, emarginate, with a short central mucro, often pubescent basally between the lateral nerves and the margin. Palea nearly as long as the lemma, occasionally exceeding it, densely ciliate. LA PAZ: MURILLO: Cotaña, 2450 m., *Buchtien* 3136 (GH).

3. *L. virgata* (L.) Beauv. *Ess. Agrost.* 166 (1812). Perennial. Leaf-sheaths and blades glabrous, glaucous, or rarely both scabridulous. Spikelets 3-3.5 mm. long. First glume about 1.5 mm. long; second glume 2 mm. long, both glumes acute, scabridulous on the central nerve. Lowest fertile lemma about 2.5 mm. long, occasionally the lowest 1 or 2 with short awns, usually the lowest puberulent along the lateral nerves. Palea nearly as long as the lemma, ciliate. SANTA CRUZ: SARA: Río Surutú, 400 m., *Steinbach* 6834 (GH).

4. *L. domingensis* (Jacq.) Trin. *Fund. Agrost.* 133 (1820). Perennial. Leaf-sheaths and blades sparsely pilose, not glaucous. Spikelets 2-3.5 mm. long. First glume about 1.5 mm. long; second glume about 2 mm. long. Fertile lemma about 2.5 mm. long, the lowest 1 or 2 awned, the awns to 2 mm. long, margins long-ciliate. Palea somewhat shorter than the lemma, not ciliate or only faintly so at the apex. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22692 (GH). SANTA CRUZ: SARA: Dolores, 450 m., *Steinbach* 1891 (GH); Buenavista, 450-500 m., *Steinbach* 1179 (GH), 5222 (GH), 6730 bis (GH).

53. *Gouinia* Fourn.

See Swallen in *Amer. Journ. Bot.* 22: 31-41 (1935).

Tufted perennials, the culms erect, to 1-1.5 m. high, leaf-sheaths glabrous, leaf-blades scabrid beneath, to 8-14 mm. wide, not equaling the inflorescence. Inflorescence an open racemose panicle. Spikelets few-flowered, the uppermost reduced, in racemes to 15 cm. long, pedicellate; rachilla glabrous; glumes subequal or the second longer, 3-nerved; lemmas longer than glumes, densely villous on the nerves, awned, the awns scabridulous.

Second glume rather obtuse, long-mucronate; panicle-branches bearing spikelets from the base; awn to 1.6 cm. long.

..... 1. *G. brasiliensis*.

Second glume acute, not mucronate; panicle-branches bearing spikelets from the middle upward; awn about 5 mm. long.

..... 2. *G. latifolia*.

1. *Gouinia brasiliensis* (S. Moore) Swallen in *Amer. Journ. Bot.* 22: 36 (1935). First glume 4 mm. long; second glume 6 mm. long. Lower

lemmas 7-8 mm. long, the awns to 1.6 cm. long. SANTA CRUZ: CORDILERA: Puerto Suarez, *Chase* 11151 (GH).

2. *G. latifolia* (Griseb.) Vasey in Contrib. U. S. Nat. Herb. 1: 365 (1895). Glumes subequal, about 5 mm. long. Lower lemmas 7 mm. long, the awns about 5 mm. long. LA PAZ: NOR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22650 (GH).

54. *Tripogon* Roem. & Schult.

Tripogon spicatus (Nees) Ekman in Ark. Bot. 11(4): 36 (1912). Densely tufted low perennial. Leaves filiform, glabrous, chiefly basal, much shorter than the culms. Inflorescence a single terminal spike, the entire culm and inflorescence usually less than 25 cm. long (60 cm. in one instance). Spikelets 5-9 mm. long, several- to many-flowered, with more than 1 perfect floret, sessile in 2 rows on the axis but usually appearing unilateral, the rachilla disarticulating above the glumes and between the florets; first glume 2 mm. long or less, subacute, second glume 2.5 mm. long, obtuse; lemmas about 3 mm. long, 3-nerved, the central nerve somewhat carinate and prolonged as a slender awn about 1 mm. long from between 2 small apical teeth, at least the lowermost lemmas with a small basal tuft of hairs; palea hyaline, much shorter than the lemma and enclosed by it. SANTA CRUZ: [province uncertain]: between Río Piray and Río Cuchi, *Herzog* 1449 (*Hitchcock*).

55. *Eleusine* Gaertn.

Eleusine indica (L.) Gaertn. Fruct. & Sem. 1: 8 (1788). Weedy annual, the culms ascending to spreading, rarely to 1 m. high, but usually less than 5 dm. Leaves nearly glabrous, the sheaths hirsute near the apex and with a ring of hairs at the apex; leaf-blades flat or folded, to 8 mm. wide, some equaling or exceeding the inflorescence, glabrous. Inflorescence terminal, with 2-5 digitate or subdigitate spikes to 10 cm. long, the spikelets in 2 rows but unilateral on the axis. Spikelets few- to several-flowered, with more than 1 perfect floret below sterile florets, sessile, 3-4 mm. long, the rachilla disarticulating above the glumes and between the florets; glumes awnless, strongly keeled, the keel scabrid, acute, first glume about 2 mm. long, the second glume about 3 mm. long; lemmas strongly keeled, the keels scabridulous, about 3 mm. long; palea bicarinate, the nerves green; caryopsis subglobose to subtrigonal, brown, finely and transversely striate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5332 (GH); NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* (in 1912) 238 (GH); Milluguaya, 1300 m., *Buchtien* (in 1917) 238 (GH). SANTA CRUZ: SARA: Río Surutú, 400 m., *Steinbach* 6837 (GH); Buenavista, 500 m., *Steinbach* 5149 (GH), 1871 (GH).

56. *Dactyloctenium* Willd.

Dactyloctenium aegyptium (L.) Willd. Enum. Hort. Berol. 1029 (1809) [as *aegyptiacum*]. Weedy, rather pilose annual, spreading by stolons and forming mats, culms erect, to 6 dm. high, leaf-sheaths glabrous or nearly so, the flat leaf-blades pilose and ciliate, shorter than the inflorescence. Inflorescence terminal, of 2-5 digitately arranged spikes 2-5 cm. long, the rachis exceeding the spikelets as a short subulate point, spikelets in 2 rows, unilateral on the axis. Spikelets several-flowered, sessile, imbricate, about 9 mm. long, the rachilla disarticulating above the glumes and between the florets; first glume about 3 mm. long, 1-nerved, acute, the second glume longer, with a short scabridulous awn arising from below the apex; lemma about 6 mm. long, 3-nerved, the central nerve keeled, scabridulous, the apex acuminate to short-awned; palea a little shorter than the lemma; caryopsis nearly globose, wrinkled or ridged. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 3132 (GH).

57. *Cynodon* L. Rich.

Cynodon Dactylon (L.) Pers. Synops. Pl. 1: 85 (1805). Low perennial, the stolons spreading extensively and rooting at the nodes, the culms produced at the nodes, with a few basal leaves, the sheaths glabrous, the short (2-3 cm.) blades scabridulous, the culms clothed in leaf-sheaths with greatly reduced free tips; fertile culms 10-40 cm. high. Inflorescence terminal, digitate, 3-6 spikes to 5 cm. long, the sessile spikelets in 2 rows along the axis, unilateral, imbricate. Spikelets 1-flowered, the rachilla disarticulating above the glumes and produced as a slender bristle behind the palea; glumes almost equal, to 3 mm. long, or the first glume shorter than the second, narrow, strongly keeled, the keel scabrid; lemma awnless, to 3 mm. long or a little longer, usually somewhat exceeding the second glume, naviculate, brown-hyaline, the central keel prominent and densely pubescent, the margins long-ciliate; palea somewhat shorter than the lemma. SANTA CRUZ: CERCADO: playa del Río Piray, 450 m., *Steinbach* 3246 (GH).

58. *Microchloa* R. Br.

Microchloa indica (L. f.) Beauv. Ess. Agrost. 13 (1812). Tufted annual, usually low in stature but sometimes the erect culms to 25 cm. high, leaves glabrous, the very narrow blades flat or folded, not equaling the inflorescence. Inflorescence a solitary terminal spike to 10 cm. long, the axis bifariously puberulent on the side toward the spikelets, the spikelets unilateral on the axis. Spikelets 1-flowered, about 3 mm. long, sessile or subsessile; disarticulation above the glumes; glumes subequal, 2.5 mm. long, 1-nerved, acute; lemma and

palea subequal, about 2 mm. long, acute, hyaline, the upper portion more or less densely covered by a long silky pubescence; caryopsis brown, subtrigonous, finely reticulate-striate. LA PAZ: MURILLO: La Paz, 3600 m., *Buchtien* 3130 (GH); Obrajes, 3450 m., *Buchtien* 9132 (GH).

59. *Gymnopogon* Beauv.

Loosely tufted perennials, the slender culms erect or spreading, 3-8 dm. high, leaves glabrous, the blades 2-5 cm. long and 2-5 mm. wide, reduced upward on the culm, never equaling nor exceeding the inflorescence. Inflorescence a terminal panicle of slender racemes 5-25 cm. long. Spikelets many, pedicellate, with 1-2 perfect florets below 1-3 sterile florets, rachilla disarticulating above the glumes; glumes subequal; fertile lemma long-awned, more or less terete.

Racemes to 5 cm. long, collected near the apex of the culm; spikelet 2-flowered. 1. *G. jubiflorus*.

Racemes 10-25 cm. long, distant along the main axis; spikelet 1-flowered, with 1-2 much reduced florets. 2. *G. spicatus*.

1. ***Gymnopogon jubiflorus*** Hitchc. in Contrib. U. S. Nat. Herb. 24: 412 (1927). Glumes subequal, the second slightly longer than the first, 3.5-4 mm. long, lance-acuminate. Fertile lemma about 2 mm. long with an apical tuft of hairs to 1.5 mm. long, the awn about 8 mm. long. Palea about as long as the lemma. LA PAZ: LARECAJA: Guanay, *Rusby* 215 (US; type).

2. ***G. spicatus*** (Spreng.) O. Ktze. Rev. Gen. 3(2): 354 (1898). First glume 3.5 mm. long; second glume 4 mm. long. Fertile lemma very narrow, 2.5 mm. long, apical hairs very short, awn 8-10 mm. long. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1932 (GH), 2357 (GH), 5386 (GH), 6977 (GH).

60. *Chloris* Swartz

Annual or perennial, with decumbent to erect culms 2 dm. to 1 m. high, leaves glabrous or scabrid or sparsely pilose, the short blades to 1 cm. wide, not equaling the inflorescence. Inflorescence terminal, composed of digitately arranged spikes in 1 or 2 whorls, the sessile spikelets unilaterally arranged. Spikelets with 1 perfect floret below 1-2 (-3) reduced and rudimentary florets, rachilla disarticulating above the glumes; glumes unequal, lemmas mucronulate or awned (awnless in no. 1).

a. Lemmas awnless. 1. *C. distichophylla*.

a. Lemmas awned or mucronulate.

b. Fertile lemmas not villous on keel (sometimes sparsely villous above), nor ciliate; sterile floret narrow, acute at apex.

c. Spikelets about 5 mm. long; fertile lemma 3-5 mm. long.

d. Spikes 6-10, 5-8 cm. long. 4. *C. Beyrichiana*.

- d. Spikes 6-15, 7-15 cm. long. 5. *C. halophila*.
- c. Spikelets about 3 mm. long; fertile lemma about 2 mm. long.
..... 6. *C. radiata*.
- b. Fertile lemmas villous on keel, at least on lower half (rarely
glabrous), margins ciliate; sterile floret broad and truncate at
the apex.
- e. Lemma long-ciliate from base to apex, the hairs 3 mm. long;
perennial. 2. *C. polydactyla*.
- e. Lemma only shortly ciliate, or glabrous at base, the hairs
increasing in length upward, the keel rarely glabrous; annual.
..... 3. *C. virgata*.

1. ***Chloris distichophylla*** Lag. Gen. & Sp. Nov. 4 (1816). Perennial. Spikelets about 3 mm. long. First glume somewhat less than 2 mm. long, 1-nerved, acute; second glume about 2.5 mm. long, 1-nerved, often mucronulate. Fertile lemma about 3 mm. long, mucronulate, the margin ciliate with long hairs decreasing in length upward. Palea shorter than the lemma. Sterile lemma shorter than the fertile, glabrous, obtuse at apex but not broadest at apex. LA PAZ: Yungas, *Bang* 267 (GH); NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* 228 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22663 (GH). SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5359 (GH), 6867 (GH).

2. ***C. polydactyla*** (L.) Swartz, Prodr. 26 (1788). Spikelets to 3.5 mm. long. First glume about 2.5 mm. long, the single nerve scabridulous; second glume about 3.5 mm. long, the central nerve scabrid. Fertile lemma about 2.5 mm. long, with a 3.5 mm. awn. LA PAZ: NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 739 (GH); Coripata, *Hitchcock* 22689 (GH).

3. ***C. virgata*** Swartz, Fl. Ind. Occ. 1: 203 (1797). Spikelets about 4 mm. long. First glume 2 mm. long; second glume 4 mm. long, mucronulate to short-awned. Fertile lemma about 3 mm. long, the awn about 1.1 cm. long. Palea about 3 mm. long, the 2 nerves lateral and ciliolate. COCHABAMBA: CERCADO: Valle de Cochabamba, 2600 m., *Steinbach* 8796 (GH).

4. ***C. Beyrichiana*** Kunth, Rév. Gram. 1: 289 (1830). Perennial. Spikelets about 5 mm. long. First glume 3 mm. long, long-acute, the nerve scabridulous; second glume about 4.5 mm. long, long-acute, the nerve scabridulous. Fertile lemma about 4.5 mm long, strongly bidentate, the awn to 1.7 cm. long. Palea shorter than lemma, densely ciliolate. LA PAZ: MURILLO: La Paz, 3300 m., *Bang* 82 (GH). COCHABAMBA: MIZQUE: Vilavila, 2500 m., *Eyerdam* 24987 (GH). TARIJA: CERCADO: Tarija, 2000 m., *Cárdenas* 200 (GH).

5. ***C. halophila*** L. R. Parodi in Revist. Argent. Agron. 12: 45 (1945). Perennial. Spikelets 5-6 mm. long. First glume 2.5 mm. long; second glume 4-4.5 mm. long. Fertile lemma about 5-5.5 mm.

long, bidentate, the awn 2 cm. long, the margins sparsely ciliate above. LA PAZ: MURILLO: Obrajes, 3400 m., *Buchtien* 573 (GH).

The original description cited several collections from the departments of Cochabamba and Tarija. I have not seen these.

6. *C. radiata* (L.) Swartz, Prodr. 26 (1788). Annual. Spikelets about 3 mm. long, but sometimes up to 5 mm. First glume about 1.5 mm. long; second glume about 3 mm. long, long-acute to very shortly awned, margins sparsely ciliate above. Palea as long as the lemma, bidentate. LA PAZ: NOR YUNGAS: near Coripata, 1700 m., *Buchtien* 8056 (GH), *Bang* 2173 (GH).

61. *Trichloris* Fourn.

Tufted perennials, the erect culms to 1 m. high, usually shorter, leaves scabrid on sheaths and blades, blades 2-10 mm. wide, not exceeding the inflorescence. Inflorescence a group of terminal spikes 5-15 cm. long. Spikelets 2-5-flowered, fertile florets below the sterile, the rachilla disarticulating above the glumes, subsessile, in 2 rows, unilateral on the rachis; first glume shorter than the second, mucronate or shortly awned; lemmas with a tuft of hairs at the base, 1-3-awned, all awns scabridulous.

Leaf-blades to 4 mm. wide; lemmas 3-awned, the awns all long; spikelets 2-flowered, the upper floret much reduced; inflorescence dense. 1. *T. mendocina*.

Leaf-blades to 10 mm. wide; lemmas with lateral awns much reduced or obsolete; spikelets 3-5-flowered, the uppermost much reduced; inflorescence much more open. 2. *T. pluriflora*.

1. *Trichloris mendocina* (Phil.) Kurtz in Mem. Fac. Cienc. Exact. Univ. Córdoba, 1897: 37 (1897). Spikelet about 3-4 mm. long (excluding the awns). First glume about 1 mm. long, very narrow, the awn 1.5 mm. long; second glume 2 mm. long, the awn 3 mm. long. Lowest lemma to 4 mm. long, pubescent on the upper portion, awns to 1.2 cm. long. SANTA CRUZ: CERCADO: Mataral, *Herzog* 1804 (Hitchcock).

2. *T. pluriflora* Fourn. Mex. Pl. 2: 142 (1886). Spikelet about 6 mm. long (excluding the awns). First glume about 1.5 mm. long, the awn much shorter; second glume about 2.5 mm. long, the awn about 0.5 mm. long. Lowest lemma 4 mm. long, ciliate, awns about 6 mm. long. SANTA CRUZ: VALLEGRANDE: Comarapa, *Herzog* 1928 (US).

62. *Bouteloua* Lag.

See Griffiths in Contrib. U. S. Nat. Herb. 14: 343-428 (1912).

Annual or perennial, the culms erect or decumbent, mostly 10-20 cm. high, occasionally to 1 m. high, leaves generally glabrous, sometimes sparsely hirsute near the edge of the sheath and on the base

of the blade, always shorter than the inflorescence, the blade narrow. Inflorescence terminal, a solitary spike or few to many short racemose spikes. Spikelets sessile, 1-flowered, with a rudimentary floret above the perfect one, unilaterally arranged; glumes present, unequal; fertile lemma 3-5-toothed, awned or awnless.

- a. Spike 1, persistent, the spikelets falling separately. 1. *B. simplex*.
- a. Spikes few to several, each spike falling entire.
 - b. Awns 2-3 cm. long. 2. *B. megapotamica*.
 - b. Awns much shorter.
 - c. Spikes at maturity erect or spreading; rachis sharply pointed at base and retrorsely bearded. 3. *B. aristidoides*.
 - c. Spikes at maturity deflexed, rachis-base neither pointed nor bearded. 4. *B. curtipendula*.

1. ***Bouteloua simplex*** Lag. in Varied. Cienc. 29(4): 141 (1805). Annual. First glume 3.5 mm. long, faintly 1-nerved; second glume to 5 mm. long, acute, strongly 1-nerved. Fertile lemma with a tuft of hairs at base, to 3 mm. long, the central awn 3 mm. long, sparsely pilose at base and along midrib. LA PAZ: MURILLO: La Paz, 3300 m., *Bang* 81 (GH); LARECAJA: vic. Sorata; Lorecasa, 2650-3200 m., *Mandon* 1325 (GH). POTOSÍ: CERCADO: Potosí, 4000 m., *Cárdenas* 197 (GH). TARIJA: AVILES: Puna Patanca, 3700 m., *Fiebrig* 2629 (GH).

2. ***B. megapotamica*** (Spreng.) O. Ktze. Rev. 3(2): 341 (1898). Perennial. Spikelet with basal tufts of hairs. First glume 3 mm. long with a 3 mm. awn, 1-nerved; second glume 7 mm. long with a 3 mm. awn, very strongly 1-nerved. Fertile lemma 4 mm. long with the central awn 1 cm. long. Palea longer than the lemma, bidentate. Reduced florets with awns to 3 cm. long. TARIJA: ARCE: Padcaya, 2100 m., *Fiebrig* 2552 (GH).

3. ***B. aristidoides*** (HBK.) Griseb. Fl. Brit. W. Ind. 537 (1864). Annual. First glume 2.5 mm. long, acute, 1-nerved; second glume 7 mm. long, puberulent at base, scabridulous above, awnless. Fertile lemma about 6 mm. long, glabrous, awnless. Palea as long as lemma, bidentate. Awns of sterile lemmas to 6 mm. long. TARIJA: Gran Chaco, *Fries* 1691 (Hitchcock).

4. ***B. curtipendula*** (Michx.) Torr. in Marcy, Red River Rept. 300 (1853). Perennial, the culms up to 1 m. high. First glume 3 mm. long, attenuate into a 2 mm. awn, the prominent central rib hispidulous; second glume 7 mm. long, awnless, bidentate, with a short point between the teeth, scabridulous near the margin and on the prominent central nerve. Fertile lemma about 6 mm. long, glabrous below, scabridulous above and on the 3 long teeth. Palea as long as lemma, bidentate, the upper half scabridulous. LA PAZ: LARECAJA: Sorata, *Mandon* 1380 (GH). COCHABAMBA: CERCADO: west of Cochabamba, 2700 m., *Eyerdam* 24875 (GH). TARIJA: ARCE: Padcaya, *Fiebrig* 3281 (GH), 3282 (GH).

63. **Munroa** Torr.

See L. R. Parodi in *Revist. Mus. La Plata*, 34: 171-193 (1934).

Low-growing, more or less tufted, spreading annuals, 2-15 cm. high, the leaves very short, the sheaths very broad, blades a few cm. long, the apex pungent. Inflorescence condensed into heads or glomerules, these more or less concealed by the sheaths of the fascicled subtending leaves. Spikelets aggregated in groups of 2 or 3, the lower 3-4-flowered, the upper 2-3-flowered, the first floret in the spikelet perfect, the others sterile, usually 3 groups in a cluster, the rachilla disarticulating above the glumes; glumes usually quite unequal; lemmas 3-nerved, the nerves much or little prolonged as awns or mucros. Caryopsis dorsally compressed.

- a. Lowest fertile lemma 4-lobed with 3 awns, the central awn longest; back of lemma with 2 tufts of hairs below the central sinus of the lobes; 2 central lobes broader than the 2 lateral, the former rather obtuse, the latter acute; margins long-ciliate for over half their length; palea with puberulent nerves. 1. *M. andina*.
- a. Lowest fertile lemma 2-3-toothed, the central tooth narrower than the laterals, its apex subaristate, the laterals mucronulate; palea glabrous.
 - b. Lowest lemma papery at base, 2-toothed with a central awn, the back with 2 tufts of hairs, the margin long-ciliate below or above the middle, the hairs reaching neither apex nor base; palea broadest at apex. 2. *M. decumbens*.
 - b. Lowest fertile lemma coriaceous at base, 3-toothed; dorsal tufts of hairs absent, the margin long-ciliate above the middle; palea broadest at the base. 3. *M. argentina*.

1. **Munroa andina** Phil. in *Anal. Mus. Nac. Chile*, 8: 90 (1891). Leaf-blades about 1 cm. long, 1 mm. wide. Glumes unequal, the second to 4 mm. long, mucronulate. Lowest lemma about 3.5 mm. long. LA PAZ: PACAJES: Calacota, 3800 m., *Asplund* 2653.

1a. *M. andina* var. *brevisetata* Hack. ex Stuckert in *Ann. Conserv. & Jard. Bot. Genève*, 17: 294 (1914). This variety is distinguished by the lowest lemma with very short awns, hardly, if at all, exceeding the lemma-lobes. LA PAZ: PACAJES: Charaña, 4050 m., *Asplund* 2691.

2. *M. decumbens* Phil. in *Anal. Mus. Nac. Chile*, 8: 90 (1891). Leaf-blades to 2.5 cm. long and 2 mm. wide. Glumes unequal, the second to 4.5 mm. long. Lowest lemma about 4 mm. long, with a 3 mm. central awn between the 2 lobes. POTOSÍ: NOR LIPEZ: Chiguana, 3700 m., *Asplund* 6504 (US); PORCO: Uyuni, 3700 m., *Asplund* 6487 (US).

3. *M. argentina* Griseb. in *Goett. Abh.* 24: 300 (1879). Leaf-blades 2 cm. long, 1 mm. wide. Glumes subequal, about as long as the lowest lemmas. Lowest lemma to 5 mm. long. POTOSÍ: SUR CHICHAS: Atocha,

3700 m., *Asplund* 6485 (US). CHUQUISACA: SUR CINTI: Camataquí, 2500 m., *Fiebrig* 2801.

With three exceptions, all specimen-citations have been taken from Parodi's treatment of the genus.

64. *Phalaris* L.

Annuals, the culms erect. Leaf-blades linear, flat, acute, from much shorter than to exceeding the inflorescence, to 6 mm. wide. Inflorescence a terminal spicate panicle. Spikelets strongly flattened, densely imbricate, the perfect floret terminal with 2 sterile lemmas below it, all concealed by the glumes; disarticulation above the glumes; glumes papery white with green stripes, the green keel broadly winged, or narrowly winged near the acute apex; sterile lemmas one-half to one-third as long as the appressed-pubescent coriaceous fertile lemma, the bicarinate palea enclosed by the fertile lemma.

Culms 3-6 dm. tall, inflorescence ovate, broad, to 5 cm. long or less; glumes broadly winged, 7-8 mm. long, sparsely long-hirsute, the hairs usually appressed. 1. *P. canariensis*.

Culms 1-1.5 m. tall, sometimes shorter; inflorescence narrowly cylindrical, 6-15 cm. long; glumes not winged or only narrowly so, especially near the apex, 3.5-4 mm. long, shortly ciliate on keel and 2 chief nerves. 2. *P. angusta*.

1. *Phalaris canariensis* L. Sp. Pl. 54 (1753). LA PAZ: MURILLO: La Paz, *Buchtien* 239 (Hitchcock); NOR YUNGAS: Coroico, *Buchtien* 3641 (Hitchcock).

2. *P. angusta* Nees ex Trin. Gram. Icon. 1: t. 78 (1827). LA PAZ: LARECAJA: Sorata, *Mandon* 1246 (Hitchcock).

65. *Leersia* Swartz

Leersia hexandra Swartz, Prodr. 21 (1788). Perennial, often sub-aquatic, scabrous or scabridulous, many culms decumbent, rhizomes slender and producing leafy stolons, fertile culms erect, sometimes to 2 m. tall, usually shorter. Leaf-blades narrow, linear-lanceolate, to 15-20 cm. long and 5 mm. wide, long-acute. Inflorescence a narrow panicle to 15 cm. long, the branches appressed. Spikelets solitary, 1-flowered, the floret perfect, disarticulating from the very short pedicel, strongly flattened, glumes lacking, lemma and palea similar in appearance, to 4-5 mm. long, often pinkish or purplish, subequal in length and width, oblong to narrowly ovate, acute, with 3 prominent ribs, these often hispidulous or the entire lemma hispidulous, the margins coarsely ciliate. SANTA CRUZ: SARA: playa del Río Perdix, 450 m., *Steinbach* 7453 (GH); Buenavista, 450 m., *Steinbach* 2180 (GH), 7116 (GH).

66. *Luziola* Juss.

Luziola peruviana Gmel. Syst. Nat. 1: 637 (1791). Perennial, usually of wet or muddy areas or even in water, the slender culms to 40 cm. long, but usually much shorter, often decumbent, branching, fertile culms erect. Leaf-blades more or less linear, long-acute, to 30 cm. long, usually much shorter, 1-4 mm. wide, exceeding the inflorescences. Spikelets 1-flowered, unisexual, disarticulating from the filiform pedicels, pistillate and staminate spikelets in separate panicles on the same plant, the staminate panicles terminal, the pistillate terminal and axillary, both short, to 6 cm. long; pistillate spikelets 2-3 mm. long, the stigmas long-plumose, the staminate spikelets 4-7 mm. long; glumes absent in both; lemma and palea similar in appearance and subequal, thin-textured, with several to many nerves, the nerves often scabridulous; caryopsis globose, rather shiny, finely striate, about 1 mm. long or longer, sometimes shortly beaked with the persistent base of the style. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1946 (GH), 6811 (GH). TARIJA: ARCE, La Merced, near Bermejo, 1700 m., *Fiebrig* 2189 (GH).

67. *Pharus* L.

Perennials, often in wet places, the culms to 1 m. high, solitary and erect, or creeping at the base and rooting at the basal nodes, forming mats. Leaf-blades petiolate, the petiole once-twisted, elliptic-oblong or lanceolate, the principal veins connected by numerous and obvious small parallel cross-veins. Inflorescence a reduced to expanded small panicle; spikelets 1-flowered, appressed, paired, the small staminate spikelet pedicellate, the pistillate sessile; 2 glumes present, dark-brown; disarticulation above the glumes; lemma terete, much exceeding the glumes, somewhat indurate, beaked, entirely or partially pubescent, the hairs somewhat uncinate, the margins incurved and concealing the palea.

- a. Lemma entirely pubescent.
 - b. Culms creeping at base and forming mats; inflorescence usually reduced and few-branched. 3. *P. parvifolius*.
 - b. Culms erect, solitary; inflorescence larger and more open. 1. *P. glaber*.
- a. Lemmas pubescent only near the beak. 2. *P. latifolius*.

1. *Pharus glaber* HBK. Nov. Gen. & Sp. 1: 196 (1816). Spikelets about 1 cm. long, about twice the length of the glumes. Leaf-blades to 25 cm. long and 5 cm. wide, abruptly short-acuminate. LA PAZ: NOR YUNGAS: Milluguaya, 900 m., *Buchtien* 4173 (GH).

2. *P. latifolius* L. Syst. Nat. (ed. 10) 2: 1269 (1759). Spikelets 1.5-2 cm. long, exceeding, but seldom twice the length of, the glumes. Leaf-blades generally broader. No Bolivian material which is un-

questionably this species has been seen, but it seems probable that the species will be found there.

3. *P. parvifolius* Nash in Bull. Torr. Bot. Club, 35: 301 (1908). Spikelets less than 1.5 cm. long. Leaf-blades generally broadest below the middle, sometimes long-acuminate. LA PAZ: SUR YUNGAS: Covendo, *White* (M. E.) 1043 (Hitchcock).

68. *Arundinella* Raddi

Tufted perennials, the erect culms from 1-2.5 m. high. Leaf-sheaths glabrous; leaf-blades shorter than or equaling the inflorescence, to 5 mm. wide, hirsutulous to scabrid along the nerves, or glabrous. Inflorescence a rather dense panicle, the pedicellate spikelets solitary. Spikelets 2-flowered, the lower floret staminate or sterile, the upper pistillate; first glume much shorter than the second, the apices divergent and often somewhat acuminate, strongly 3-nerved, the second glume at least twice the length of the sterile and fertile lemmas, or equal to the sterile lemma; disarticulation above glumes; fertile lemma shortly villous on the basal callus, scabridulous, bearing a geniculate awn about 1 cm. long or less, completely enclosing the palea.

Culms to 2.5 m. high; inflorescence-branches and pedicels densely and retrorsely scabridulous; glumes 2-2.5 mm. long; lemmas 2-2.5 mm. long; awn basally twisted, about 2 mm. long. 1. *A. confinis*.

Culms usually less than 1 m. high; inflorescence-branches and pedicels glabrous to faintly scabridulous; glumes 3-5 mm. long; lemmas 1.5 mm. long; awn about 1 cm. long, not twisted basally.

..... 2. *A. Berteroniana*.

1. *Arundinella confinis* (Schult.) Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 290 (1917). SANTA CRUZ: SARA: Buenavista, *Steinbach* 6888 bis (GH).

2. *A. Berteroniana* (Schult.) Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 290 (1917). LA PAZ: LARECAJA: Mapiri, *Buchtien* 1175; SUR YUNGAS: Covendo, *White* (M. E.) 995. BENI: YACUMA; Rurrenabaque, *Cárdenas* (M. E.) 1166. Citations from Hitchcock.

69. *Trichopteryx* Nees

Trichopteryx flammida (Trin.) Benth. ex Jacks. & Hook. f. Index Kew. 4: 1109 (1895). Tufted perennial, the culms 1.5-2 m. high. Leaf-sheaths glabrous to hirsute; leaf-blades sometimes exceeding the inflorescence, flat, to 7 mm. wide. Inflorescence terminal, a rather dense panicle, to 60 cm. long, the spikelets solitary, pedicellate, the pedicels bearing a few long hairs at the apex. Spikelets 2-flowered, the lower floret staminate, glabrous and awnless, the upper floret pistillate; first glume 4-5 mm. long, strongly 3-nerved, the nerves ciliolate, with 3-5 erect hairs 3-4 mm. long near the apex, second

glume 4-5 mm. long, less strongly nerved, glabrous; disarticulation above the glumes; lemma of staminate floret about 6 mm. long, glabrous, nearly twice the length of the hyaline palea; lemma of pistillate floret 3-4 mm. long, densely long-pubescent, bearing a scabridulous awn up to 2 cm. long, this geniculate shortly above its base. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 9 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1884 (GH), 5358 (GH), 6958 (GH).

The authorship of this combination is often given as Benthams in *Journ. Linn. Soc. Bot.* 19: 59 (1882), but examination shows that the combination was not actually made there. It was merely implied.

70. *Tristachya* Nees

Tristachya chrysothrix Nees, *Agrost. Bras.* 460 (1829). Tufted perennial, the culms to 1 m. high, the leaf-sheaths hirsute to hispidulous or glabrous. Leaf-blades flat to involute, hirsute to almost glabrous, not exceeding the inflorescence, to 4 mm. wide (when flattened). Inflorescence a lax, nearly simple panicle, the branches puberulent to glabrous below, hirsute above, the hairs golden-brown, spikelets sessile in groups of 3, terminal on the branches. Spikelets 2-flowered, the lower floret staminate and awnless, the upper floret pistillate; first glume about 1 cm. long, 3-nerved, each lateral nerve with a row of short, dark brown tubercles, each bearing a long golden-brown hair, second glume to 1.5 cm. long, pubescent along the margins in the upper portion; disarticulation above the glumes; lemmas of staminate floret glabrous, about 1.2 cm. long, the palea 2-nerved, ciliate; lemma of pistillate floret about 7 mm. long, densely pubescent, the base surrounded by longer, white, silky hairs, bearing a twisted awn 4-7 cm. long, rising between 2 slender teeth, the lower portion brown and hispidulous, the upper portion green and more nearly scabridulous. SANTA CRUZ: VALLEGRANDE: Samaipata, 2000 m., *Steinbach* 3772 (GH).

71. *Leptocoryphium* Nees

Leptocoryphium lanatum (HBK.) Nees, *Agrost. Bras.* 84 (1829). Perennial, to 1 m. high. Leaves glabrous, the blades flat or often involute, to 3 mm. wide, linear. Inflorescence a rather lax, narrow, racemose, terminal panicle, the rachis, branches and pedicels glabrous. Spikelets 2-flowered, the lower floret a sterile lemma, the other perfect, disarticulation below the glumes. First glume absent; second glume to nearly 5 mm. long, strongly several-nerved, long-pilose, the hairs mostly confined to the nerves. Sterile lemma as long as the glume and similar in appearance and pilosity. Fertile lemma about as long

as the sterile, thin-textured, the margins sparsely ciliate, the apex slightly erose-fimbriate. Palea nearly as long as the fertile lemma, thin, not carinate. LA PAZ: LARECAJA: Hacienda Casana, 1600 m., *Buchtien* 7146 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 3269 (GH), 6639 (GH), 6640 (GH).

72. *Trichachne* Nees

Perennials, the bases somewhat swollen and felty-pubescent or scaly. Leaf-sheaths glabrous or papillate-hirsute; leaf-blades glabrous or scabridulous. Inflorescence a panicle of shortish racemes. Spikelets paired, pedicellate, 2-flowered, the lower floret a sterile lemma, the upper floret perfect, silky-villous; disarticulation below the glumes. Glumes very unequal; second glume and sterile lemma similar and subequal; fertile lemma firm-textured and acuminate; palea similar but narrower.

- a. Sterile lemma silky-villous dorsally. 1. *T. insularis*.
a. Sterile lemma glabrous dorsally.

b. Leaf-sheaths glabrous; blades to 7-8 mm. wide; fertile lemma about 3 mm. long. 2. *T. sacchariflora*.

b. Leaf-sheaths sparsely papillate-hirsute (at least when young); blades to 5 mm. wide, glabrous to puberulent; fertile lemma 2.5 mm. long. 3. *T. californica*.

1. *Trichachne insularis* (L.) Nees, *Agrost. Bras.* 86 (1829). Plants to 1.5 m. tall. Leaf-sheaths rather sparsely papillate-hirsute; leaf-blades to 1.5 cm. wide, scabridulous above. Panicle to 3 dm. long, the racemes to 15 cm. long, tawny when mature. Spikelets to 4 mm. long. First glume over 0.5 mm. long, obtuse; second glume 3 mm. long, acute, silky-villous. Sterile lemma 4 mm. long, not glabrous dorsally. Fertile lemma 3.5 mm. long. LA PAZ: NOR YUNGAS: Milluguaya, 1200 m., *Buchtien* 4188 (GH). COCHABAMBA: CHAPARE: Antahuacana, Espiritu Santo, 750 m., *Buchtien* s. n. (GH).

2. *T. sacchariflora* (Raddi) Nees, *Agrost. Bras.* 87 (1829). *T. affinis* Swallen in *Rhodora*, 65: 355 (1963). Plants to 8 dm. tall. Leaf-sheaths glabrous; leaf-blades to 7-8 mm. wide, glabrous. Panicle to 20 cm. long, the racemes often more than 5 cm. long. Spikelets about 3-4 mm. long, silky-villous, the hairs white to purplish. First glume less than 0.5 mm. long, apex broadly truncate and usually erosulous, glabrous; second glume as long as the spikelet, acute, the hairs basal, marginal and on the nerves. Sterile lemma as long as the spikelet, acute, apically somewhat lanate-penicillate, the remaining hairs between the margins and the marginal nerves. Fertile lemma about 3 mm. long, longitudinally striatulate. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 31 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6638 (GH), 6876 (GH); Dolores, 450 m., *Steinbach* 1911 (GH).

3. *T. californica* (Benth.) Chase in *Journ. Wash. Acad. Sci.* 23:

455 (1933). *T. saccharata* of the Catalogue. Plants 4-10 dm. tall. Leaf-sheaths glabrous to sparsely papillate-pilose; leaf-blades to 5 mm. wide, glabrous to puberulent. Panicle to 10 (-15) cm. long, racemes few, mostly to 5 cm. long. Spikelets about 3-3.5 mm. long, mostly obscured by the long white hairs. First glume about 0.5 mm. long, truncately obtuse to subacute. Sterile lemma as long as the spikelet, 3-nerved, densely villous between the marginal nerves and the margin, glabrous dorsally. Fertile lemma 2.5 mm. long, glabrous, finely striatulate. COCHABAMBA: CERCADO: Cochabamba, *Holway* 321 (Hitchcock), 368 (Hitchcock).

73. *Digitaria* Heister

See Henrard, J. Th. Monograph of the Genus *Digitaria*. Leiden, 1950.

Annuals or perennials, the culms 0.4-1 m. tall. Leaf-sheaths and blades often papillate-hirsute, the blades sparsely so, to glabrous or glabrate. Inflorescence a panicle of racemes, these digitate, subdigitate, solitary or irregularly arranged along the axis. Spikelets 2-flowered, the lower floret a sterile lemma, pedicellate in groups of 2 or 3, unilateral, in 2 rows. Glumes very unequal, the first glume minute or wanting; second glume and sterile lemma similar. Fertile lemma firm-textured and somewhat pitted-striatulate.

- a. First glume present, minute.
 - b. Spikelets about 3 mm. long (2.5-3.5); rachis of inflorescence without hispid hairs. 1. *D. adscendens*.
 - b. Spikelets 2 mm. long; rachis with sparse, long, hispid hairs, especially at the nodes. 2. *D. horizontalis*.
- a. First glume absent.
 - c. Spikelets 1.5 mm. long, or less. 3. *D. violascens*.
 - c. Spikelets 2.5 mm. long.
 - d. Second glume obtuse, shorter than the dark brown fruit. 4. *D. leiantha*.
 - d. Second glume acute, longer than the pale fruit. 5. *D. lanuginosa*.

1. *Digitaria adscendens* (HBK.) Henr. in *Blumea*, 1: 92 (1934). Weedy annual, decumbent and spreading, the culms to 1 m. long but usually much shorter. Leaf-sheaths papillate-hirsute; leaf-blades to 1 cm. wide, pubescent to glabrous. Racemes to 10 (-15) cm. long, the rachis 0.5 mm. wide, with margins as wide as the central rib, digitate or in several whorls. First glume less than 0.5 mm. long; second glume about 1.5 mm. long, ciliate. Sterile lemma acute, 3-nerved, pubescent along the nerves but mostly between the lateral nerves and the margins. Fertile lemma about 3 mm. long, light in color and finely pitted. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5318 (GH); NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* (in 1912) 444 (GH); Milluguaya, 1300 m., *Buchtien* (in

1917) 444 (GH). SANTA CRUZ: SARA: Río Surutú, 400 m., *Steinbach* 6839 (GH); Buenavista, 450 m., *Steinbach* 6848 (GH), 7057 (GH).

2. *D. horizontalis* Willd. Enum. Pl. 92 (1809). Annual. Leaf-sheaths usually papillate-hirsute; blades to 1 cm. wide, densely pubescent. Raceme-rachis almost without a margin, with scattered, long, hispid hairs, these prominent at the nodes. Spikelets 2 mm. long. First glume minute; second glume about 1 mm. long, subacute, ciliate on upper margin. Sterile lemma 2 mm. long, puberulent near the margin. Fertile lemma pale, acute, shorter than the sterile lemma. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6986 (GH).

3. *D. violascens* Link, Hort. Berol. 1: 229 (1927). Annual, decumbent, to 8 dm. tall. Leaf-sheaths usually glabrous; leaf-blades to 6 mm. wide, glabrous or pubescent. Racemes 2-5, digitate or subdigitate, the rachis-margins very narrow. Spikelets to 1.5 mm. long, puberulent or glabrous. First glume wanting; second glume about 1 mm. long. Sterile lemma as long as the spikelet. Fertile lemma dark-brown, shining. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5335 (GH); NOR YUNGAS: Coripata, *Hitchcock* 22674 (GH).

4. *D. leiantha* (Hack.) Parodi in *Physis*, 7: 57 (1923). Perennial, to 1 m. tall, glabrous. Racemes stiff, erect. Spikelets 3 mm. long, glabrous. First glume absent; second glume obtuse, shorter than the spikelet. Sterile lemma as long as the spikelet. Fertile lemma acute, shining, chestnut-brown. SANTA CRUZ: VALLEGRANDE: Coripata, *Herzog* 1763 (US).

5. *D. lanuginosa* (Nees) Henr. in *Meded. Rijks Herb. Leiden*, no. 61: 5 (1930). Perennial, to 1 m. tall. Leaf-sheaths and blades pubescent. Racemes to 10 cm. long. Spikelets 2.5 mm. long, pubescent on the nerves, acuminate. First glume absent; second glume and sterile lemma as long as the spikelet. Fertile glume shorter than the sterile lemma and glume, pale in color. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6849 (GH), 6877 (GH).

74. *Thrasya* HBK.

Thrasya campylostachya (Hack.) Chase in *Proc. Biol. Soc. Wash.* 24: 115 (1911). Perennial, to about 5 dm. high. Leaf-sheaths densely ciliate, the linear blades to 5 mm. wide, sparsely ciliate and densely puberulent. Inflorescence solitary, terminal or axillary racemes to 9 cm. long, the base often partly sheathed by a stem-leaf, the rachis rather broadly winged and partly concealing the bases of the paired, shortly pedicellate spikelets. Spikelets about 3 mm. long, unilateral, disarticulation below the glumes, 2-flowered, the lower a sterile lemma. First glume usually hyaline, 1 mm. long or less, the second glume about 2.5 mm. long, about 5-nerved, the back rounded, often puberulent along the nerves, the apex shortly penicillate. Lemma about 2.5 mm. long, usually slightly shorter than the second glume, indurate, finely striate, the apex shortly penicillate. Palea shorter than the

lemma, indurate, striate, the 2 keels thick, rounded and shining. LA PAZ: NOR YUNGAS: San José, 1500 m., *Hitchcock* 22733 (GH); Coripata, *Hitchcock* 22694 (GH).

75. *Pseudechinolaena* Stapf

Pseudechinolaena polystachya (HBK.) Stapf in Prain, Fl. Trop. Afr. 9: 495 (1919). Sprawling annual, in moist habitats, rooting at the nodes, the fruiting culms to 5 dm. high. Leaf-sheaths densely pilose, the lance-ovate blades to 6 cm. long, sparsely pilose above and beneath. Inflorescence axillary or terminal, the racemes solitary or arranged in a lax panicle, the rachis, branches and pedicels scabridulous-puberulent, the individual racemes 2-5 cm. long. Spikelets 2-flowered, the lower floret sterile or staminate, the upper perfect, about 4 mm. long, disarticulation below the glumes. First glume about 3 mm. long, 5-nerved, rather sparsely short-hispid; second glume 4 mm. long, several-nerved, short-hispid when young, ventricose and uncinately spiny at maturity. Sterile lemma firm, minutely papillate, slightly shorter than the second glume, its palea nearly as long, but much narrower. Fertile lemma about 2 mm. long, shining, indurate, the narrow indurate palea about as long. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5320 (GH); Polo-Polo, 1100 m., *Buchtien* 265 (GH); Milluguaya, 1300 m., *Buchtien* 265 (GH). COCHABAMBA: CHAPARE: Locotal, 1500 m., *Steinbach* 9054 (GH), 9070 bis (GH).

76. *Rhynchelytrum* Nees

Rhynchelytrum repens (Willd.) C. E. Hubb. in Kew Bull. 1934: 110 (1934). *Tricholaena rosea* of the Catalogue. Annual (or sometimes perennial?), often decumbent at the base, the culms to 1 m. tall. Leaf-sheaths glabrous to sparsely papillate-hirsute; leaf-blades flat, to 2-7 mm. wide, glabrous. Inflorescence an open terminal panicle, to 15 cm. long, the axis glabrous below to puberulent above, branches puberulent around the nodes, pedicels glabrous. Spikelets 2-flowered, the lower floret a sterile or staminate lemma, about 4-5 mm. long (excluding hairs), disarticulation below the glumes. First glume to 1.5 mm. long, extremely obtuse or truncate, silky-villous; second glume to 4 mm. long, apically obtuse and bidentate, with a 1.5 mm. awn arising from the base of the sinus, long-ciliate, densely silky-villous (at least below), the hairs exceeding the spikelet by 4-5 mm. Sterile lemma as long as second glume, bidentate, shortly awned, silky-villous. Fertile lemma 2.5-3 mm. long, glabrous, rather shining, obtuse, palea similar and nearly as long, but narrower. COCHABAMBA: CERCADO: about 5 km. southeast of Cochabamba, 2800 m., *Eyerdam* 24918 (GH).

The panicle of this ornamental grass varies in color from white and gray to pale or deep rosy-purple.

77. *Mesosetum* Steud.

See Swallen in Brittonia, 2: 363-392 (1937).

Mesosetum cayennense Steud. Syn. Gram. 118 (1854). Perennial, caespitose, 3-12 dm. high. Leaf-sheaths pilose, ciliate, the flat blades to 5 mm. wide, papillose-pilose above and beneath. Inflorescence a solitary terminal raceme to 20 cm. long, the spikelets solitary, unilateral in 2 rows on the rachis. Spikelets 4-5 mm. long, 2-flowered, the lower floret a sterile lemma, or sometimes staminate, the upper floret perfect, disarticulation below the glumes. Glumes unequal, the first to 3 mm. long, truncate, the apex somewhat erose, the margins appressed-pilose below with a tuft of long hairs on each side at the middle, the back toward the rachis; second glume to 5 mm. long, the margins appressed-pilose on the lower half, a tuft of hairs on each side at the middle, and a tuft of long hairs on each margin well below the erose or bidentate apex. Sterile lemma somewhat shorter than the second glume, a tuft of long hairs on each margin at the middle, a few hairs at the base. Fertile lemma smooth, shining, about 3 mm. long. LA PAZ: CAUPOLICÁN: Ixiamas, *White* (M. E.) 2318 (Swallen).

78. *Eriochloa* HBK.

Erect perennials, 2 dm. to 1 m. tall. Inflorescence a terminal panicle of 2-many somewhat distant racemes. Spikelets short-pedicellate, unilateral in 2 rows, 2-flowered, the lower floret a sterile lemma, the first glume a minute sheath adnate to the first rachilla-joint as a thickened callus; second glume and sterile lemma similar in appearance and size, the glume sometimes awned; fertile lemma indurate, finely papillate-rugulose, mucronate or awned or merely penicillate.

Pedicels pilose, with an apical ring of long hairs; leaf-blades narrow

(to 4 mm.); racemes 2 (-3). 1. *E. distachya*.

Pedicels puberulent, lacking an apical ring of long hairs; leaf-blades to 1.5 cm. wide; racemes numerous. 2. *E. punctata*.

1. ***Eriochloa distachya*** HBK. Nov. Gen. & Sp. 1: 95 (1816). Plants 2-4 dm. tall, branched, the nodes pubescent, leaves glabrous, blades to 4 mm. wide. Inflorescence of 2, rarely 3, racemes 1-2 cm. long; main axis, raceme-axes and pedicels pilose to pilose-hispid, the pedicels with an apical ring of long hairs. Spikelets about 4 mm. long (excluding the awn). Second glume and sterile lemma pilose, acute, the glume sometimes awned. Fertile lemma 2.5-3 mm. long, the apex penicillate. SANTA CRUZ: SARA: Río Dolores, *Steinbach* 1940 (GH).

2. *E. punctata* (L.) Desv. ex Hamilton, Prodr. Pl. Ind. Occ. 5 (1825). Plants to 1 m. or more in height, basally decumbent, branched, nodes puberulent, leaves glabrous, the blades flat, to 1.5 cm. wide. Inflorescence of numerous racemes mostly over 2 cm. long; main axis and raceme-axes pilose, pedicels puberulent and without an apical ring of long hairs. Spikelets about 4 mm. long. Second glume and sterile lemma sparsely pilose, acute. Fertile lemma over 2 mm. long, the apex not penicillate but awned, the awn about 1 mm. long. LA PAZ: NOR YUNGAS: Coripata, Hacienda El Choro, 1700 m., *Buchtien* 8040 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22666 (GH).

79. *Brachiaria* (Trin.) Griseb.

Brachiaria plantaginea (Link) Hitchc. in Contrib. U. S. Nat. Herb. 12: 212 (1909). Annual, decumbent, rooting at the nodes, culms to 5 dm. high. Leaves glabrous, the lance-ovate blades to 1.5 cm. wide. Inflorescence a series of terminal, unilateral racemes to 7 cm. long, the solitary spikelets in 2 rows along the rachis. Spikelets 2-flowered, the lower floret sterile or staminate, the upper floret perfect, to 5 mm. long, disarticulation below the glumes. Glumes subequal to unequal; first glume about 2 mm. long, but often longer, completely surrounding the base of the second glume, rather thin-textured, about 7-nerved, its back toward the rachis, second glume to 5 mm. long, firmer-textured, about 7-nerved, the apex sometimes mucronulate. Sterile lemma as long as the second glume and similar in appearance. Fertile lemma about 3 mm. long, somewhat indurate, densely papillate-striate. Palea similar to fertile lemma, enfolded by the margins of the latter. LA PAZ: NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 443 (GH); Milluguaya, 1300 m., *Buchtien* 158 (GH); Coripata, 1700 m., *Buchtien* 8041 (GH).

80. *Axonopus* Beauv.

See Black in Advancing Frontiers of Plant Science, vol. 5 (1963).

Perennial (1 Bolivian species annual), mostly tall. Leaf-blades involute or flat or folded. Inflorescence a panicle or subpaniculate, of few to many racemes conjugate, digitate, or distant along a common axis. Spikelets solitary, unilateral in 2 rows along the rachis, disarticulation below the glumes, 2-flowered, the lower floret a sterile lemma, the perfect floret above it. First glume absent; second glume and sterile lemma more or less alike in size and appearance; second glume and fertile lemma turned away from the rachis. Fertile lemma indurate, whitish or yellowish to dark brown, the margins curved over the edge of the similar palea but not enclosing it.

a. Rachis hispid or pilose.

b. Rachis-hairs not hispid nor papillate-based. 10. *A. pilosus*.

b. Rachis-hairs hispid, papillate-based.

- c. Hairs not yellow nor golden-brown. 14. *A. elegantulus*.
- c. Hairs yellow to golden-brown.
 - d. Spikelets in cupular cavities along the rachis. 17. *A. chrysoblepharis*.
 - d. Spikelets not in cupular cavities.
 - e. Rachis not obviously flexuose; glume with papillate-hispid hairs on the nerves. 16. *A. Herzogii*.
 - e. Rachis obviously flexuose; glume without papillate-hispid hairs.
 - f. Glume and sterile lemma glabrous, occasionally very slightly puberulent. 19. *A. chrysites*.
 - f. Glume and sterile lemma shortly and finely pubescent. 18. *A. exasperatus*.
- a. Rachis neither hispid nor ciliate.
 - g. Spikelets obviously hirsute. 2. *A. marginatus*.
 - g. Spikelets not hirsute but glabrous to sparsely puberulent.
 - h. Leaves papillate-pilose, at least when young.
 - i. Leaf-blades to 4 mm. wide. 4. *A. hirsutus*.
 - i. Leaf-blades to 3 cm. wide. 12. *A. scoparius*.
 - h. Leaves essentially glabrous, at least on upper surface.
 - j. Culm-nodes not glabrous.
 - k. Racemes 2-4 in panicle; if 4, the upper 2 conjugate. 6a. *A. compressus* var. *macropodius*.
 - k. Racemes much more numerous in panicle.
 - l. Racemes up to 20; distant and divergent on the common axis. 13. *A. iridifolius*.
 - l. Racemes more than 20; approximate and ascending on the common axis.
 - m. Spikelets about 2 mm. long; leaf-blades subpetiolate at base. 7. *A. eminens* var. *bolivianus*.
 - m. Spikelets about 2.5 (-3) mm. long; blades not subpetiolate. 8. *A. barbigerus*.
 - j. Culm-nodes glabrous.
 - n. Leaf-blades abruptly rounded at base.
 - o. Spikelets to 1.6 mm. long. 15. *A. capillaris*.
 - o. Spikelets to 2.4 mm. long. 6. *A. compressus*.
 - n. Leaf-blades not abruptly rounded at base.
 - p. Blades tightly involute, appearing terete. 9. *A. siccus*.
 - p. Blades flat or folded.
 - q. Blades acuminate, acute. 11. *A. andinus*.
 - q. Blades not acuminate, obtuse.
 - r. Culms mostly 2 dm. tall. 5. *A. fissifolius*.
 - r. Culms about 6 dm. tall.
 - s. Glumes pilose on the nerves, especially at base and apex. 1. *A. Purpusii*.

s. Glumes sparsely puberulent to glabrous.
 3. *A. affinis*.

1. ***Axonopus Purpusii*** (Mez) Chase in Journ. Wash. Acad. Sci. 17: 144 (1927). Perennial, to 7 dm. tall, culm-nodes usually glabrous. Leaf-sheaths ciliate, at least near summit; blades flat or folded, to 4 mm. wide, shorter than inflorescence, glabrous or sparsely papillate-pubescent, ciliate at the base. Inflorescence of 2-7 erect racemes, to 7 cm. long, the rachis scabridulous, flexuose, the pedicels sometimes densely hairy. Spikelets to 2.2 mm. long, ovoid to oblong, greenish or brownish-purple. Glume and sterile lemma equal, mostly 2-nerved, the mid-nerve absent, pilose on the nerves, at least at base and apex. Fertile lemma a little shorter than or equaling the spikelet, yellowish, glabrous or minutely penicillate at apex. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7060 bis, in part (GH).

The description given is based in part on an isotype in the Gray Herbarium, *Purpus* 2450.

2. ***A. marginatus*** (Trin.) Chase in Contrib. U. S. Nat. Herb. 17: 226 (1913). Perennial, to 8.5 dm. high, sometimes stoloniferous or rhizomatous. Culm-nodes pubescent or barbate, sometimes glabrous. Leaf-sheaths glabrous, or pilose near the apex; blades 2-4 mm. wide, to 30 cm. long, flat or folded, ciliate at base, glabrous above, pilose or sparsely pilose beneath, the obtusely acuminate apex naviculate. Inflorescence of up to 13 ascending racemes to 15 cm. long, the rachis scabrid, pedicels pubescent, especially on the margins. Spikelets 2-3 mm. long, ellipsoid to oblong. Glume and sterile lemma equal, 2-4-nerved, mid-nerve absent, densely hairy along (but seldom on) the nerves, the hairs dark purple to silvery, becoming light to dark brown. Fertile lemma about equal to sterile lemma, white or nearly so, the apex penicillate. LA PAZ: LARECAJA: Hacienda Casana, 1600 m., *Buchtien* 7118 (US).

3. ***A. affinis*** Chase in Journ. Wash. Acad. Sci. 28: 180 (1938). Caespitose perennial, to 6.5 dm. tall. Culms erect or geniculate, the nodes glabrous. Leaf-sheaths ciliate toward apex, otherwise glabrous; blades folded or flat, the base sometimes sparsely pilose, otherwise glabrous. Inflorescences terminal the panicle of 2-7 racemes to about 8 cm. long, rachis glabrous or slightly scabridulous, straight to flexuose. Spikelet to 2.1 mm. long, elliptic to ovate. Glume and sterile lemma equal, 2-4-nerved, midrib absent, lateral nerves sparsely pubescent to glabrous. Fertile lemma equal to or somewhat shorter than the sterile lemma, pale yellow, glabrous or the apex somewhat penicillate. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5183 (GH), 6724 (GH), 6847 (GH).

4. ***A. hirsutus*** G. A. Black in Advanc. Front. Pl. Sci. 5: 55 (1963). Perennial, the culms to 2.5 dm. tall, nodes densely pilose. Leaf-sheaths carinate, densely ciliate, densely pilose at the apex; blades to 20 cm. long, 4 mm. wide, flat, linear, attenuate at the apex, densely papillate-

pilose, ultimately glabrescent. Inflorescence terminal, solitary, of 4-5 subdigitate racemes to 8 cm. long, rachis scabrous, flexuose. Spikelet to 1.6 mm. long, ovate to oblong-elliptic. Glume and sterile lemma equal, 2-4-nerved, sparsely pubescent along the inner nerves. Fertile lemma slightly shorter, stramineous to brown, shining, glabrous. SANTA CRUZ: SARA: Matacú [Motacú] — Portachuelo, *Steinbach* 1979 (GH; probable isotype).

5. *A. fissifolius* (Raddi) Kuhl. in Comm. Linh. Telegr. Estrat. Matto Grosso Amazonas, Publ. 67, Anexo 5, Bot. 11: 87 (1922). Perennial, to 4.5 dm. tall (usually about 2 dm.), nodes glabrous. Leaf-sheaths ciliate at the apex; blades to 4 mm. wide, usually glabrous, ciliate at the base, obtuse. Inflorescences mostly terminal panicles of 1-3 racemes to 7 cm. long (occasionally to 10 cm.); rachis glabrous, straight to flexuose. Spikelet to 2.1 mm. long, ovate to elliptic. Glumes and sterile lemma equal, 2-4-nerved, sparsely pubescent on the nerves, stramineous. Fertile lemma as long as the sterile, light yellow to whitish, glabrous or minutely penicillate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5326 (GH); NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 267 (GH); Coroico, 1560 m., *Hitchcock* 22716 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22625 (GH). SANTA CRUZ: SARA: Buenavista, Dolores, *Steinbach* 1908 (GH).

6. *A. compressus* (Swartz) Beauv. Ess. Agrost. 154 (1812). Perennial, stoloniferous. Culms to 8 dm. high, but usually to 4.5 dm., nodes glabrous to pubescent. Leaf-sheaths ciliate, pubescent near the apex or glabrous; blades flat, to 2 cm. wide, lance-linear to ovate, usually ciliate, sometimes the upper surface pubescent to pilose. Inflorescences terminal or terminal and lateral, the panicle of 2-5 racemes to 13 cm. long, the uppermost conjugate; rachis scabrid to pilose, flexuose or nearly straight. Spikelet to 3 mm. long on pedicels up to 1 mm. long. Glume and sterile lemma equal, 2-5-nerved, sparsely pubescent along the outermost nerves, or glabrous, stramineous to purple. Fertile lemma to 1.8 mm. long, glabrous or shortly penicillate. SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5159 (GH); Dolores, *Steinbach* 1907 (GH).

6a. *A. compressus* var. *macropodius* (Steud.) G. A. Black in Advanc. Front. Pl. Sci. 5: 82 (1963). Perennial, to 6 dm. high, culm-nodes pilose. Leaf-sheaths glabrous except along the margins and at the apex; blades to 2 dm. long and 12 mm. wide, elliptic, ciliate near the base; petiolately narrowed at the base, apex obtuse. Panicle of 2-4 racemes, these often conjugate, rachis and pedicels glabrous. Spikelet to 2.5 mm. long. Second glume and sterile lemma 2-4-nerved, very sparsely short-pilose along the nerves, especially at the base. Fertile lemma about 0.75 mm. shorter than the sterile lemma, whitish, more or less striate or papillate-striate. COCHABAMBA: CHAPARE: Antahuacana, Espíritu Santo, 750 m., *Buchtien* 2505 (US).

7. *A. eminens* var. *bolivianus* G. A. Black in *Advanc. Front. Pl. Sci.* 5: 93 (1963). Perennial, robust, to 2.5 m. tall (*fide* Steinbach), the culm-nodes densely barbate. Leaf-sheaths densely ciliate and pilose near the apex; blades involute, subpetiolate at the base, becoming flat, to 1 cm. wide, upper surface pilose near the base, the apex long-acuminate to pungent. Panicle terminal, to 35 cm. long, of numerous approximate racemes (usually at least 50) to 18 cm. long; rachis scabrous. Spikelet to 2 mm. long, ovoid; glume and sterile lemma equal, 5-nerved, glabrous or sparsely pubescent. Fertile lemma shorter than the sterile, white, glabrous to penicillate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6976 (GH).
8. *A. barbigerus* (Kunth) Hitchc. in *Contrib. U. S. Nat. Herb.* 24: 433 (1927). Stout perennial, the culms to 1-2 m. tall, nodes usually densely pilose but occasionally glabrous. Leaf-sheaths ciliate at the apex, the base sometimes pubescent; blades to 9 dm. long and 6 mm. wide, long-attenuate at the apex, involute or folded at the base. Inflorescences terminal, usually solitary, of 10-50 or more ascending racemes to 20-30 cm. long, rachis scabrous with occasional long hairs. Spikelet about 2.5 mm. long (but occasionally to 3.1 mm.). Glume and sterile lemma equal, 5-nerved, glabrous or sparsely pubescent between the nerves. Fertile lemma about equaling the sterile, or shorter, pale yellow to white, glabrous or penicillate. LA PAZ: [province unknown]: Puente Villa, *Cárdenas* 3608 (GH). SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1920 (GH), 5377 (GH).
9. *A. siccus* (Nees) Kuhlman in *Comm. Linh. Telegr. Estrat. Matto Grosso Amazonas*, Publ. 67, Anexo 5, Bot. 11: 87 (1922). Slender perennial, the culms mostly to 9 dm. tall but occasionally much taller, the nodes usually glabrous. Leaf-sheaths ciliate, at least near the apex; blades tightly involute, appearing terete, the apex slender and filamentous. Panicles terminal, of 4-30 racemes to 15 cm. long, rachis scabrid. Spikelets to 2.1 mm. long. Glumes and sterile lemma equal, 5-nerved, glabrous, or puberulent between the nerves. Fertile lemma equalling the sterile, white to stramineous, glabrous or penicillate. SANTA CRUZ: VALLEGRANDE: Samaipata, *Herzog* 1709 (US). TARIJA: O'CONNOR: Narvaez, 2700 m., *Cárdenas* 4935 (US).
10. *A. pilosus* G. A. Black in *Advanc. Front. Pl. Sci.* 5: 100 (1963). Perennial, the culms to 5 dm. tall with pubescent nodes. Leaf-sheaths somewhat pilose, especially near the apex, the hairs tufted at the base of the blade; blades to 2.5 mm. wide, folded, ciliate at the base, the upper surface pilose, the apex very long-acuminate or filamentous. Inflorescence a solitary terminal panicle of many (to 25) racemes to 10 cm. long; rachis flexuose, densely pilose, the hairs not hispid nor yellow-brown, mostly aggregated around the short pedicels. Spikelets to 2.7 mm. long, long-ellipsoid, often purplish. Glume and sterile lemma equal, 5-nerved, glabrous to sparsely pubescent. Fertile lemma

greenish to white, penicillate. TARIJA: MENDEZ: Tucumilla, 2600 m., *Fiebrig* 2782 (GH; type-number).

11. *A. andinus* G. A. Black in *Advanc. Front. Pl. Sci.* 5: 111 (1963). Perennial, to 1 m. tall, culm-nodes glabrous. Leaf-sheaths somewhat short-pilose at the apex, otherwise glabrous; blades long, to 5 mm. wide, loosely folded or flat, glabrous or with a few hairs on the upper surface at the base. Panicles of 5-7 racemes to 10 cm. long; rachis and pedicels scabrid on the angles. Spikelets about 2.5 mm. long, lanceolate. Second glume and sterile lemma equal, often purplish (at least on the type), 2-4-nerved, the nerves short-pilose. Fertile lemma shorter than the sterile, yellowish-white, obscurely striatulate, the acute apex penicillate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5328 (US; type).

12. *A. scoparius* (Flügge) Kuhlman in *Comm. Linh. Electr. Estrat. Matto Grosso Amazonas*, Publ. 67, Anexo 5, *Bot.* 11: 45 (1922). *Paspalum tripinnatum* Mez in *Fedde, Rep. Sp. Nov.* 15: 64 (1917). Stout perennial, the culms to 1.5 m. tall, nodes glabrous. Leaf-sheaths glabrous; blades to 5 dm. long and 3 cm. wide, the apex obtuse, the upper surface papillate-pilose. Inflorescences terminal (sometimes axillary as well), of few to 100 racemes to 20 cm. long; rachis scabrid and sometimes sparsely short-pilose. Spikelets to 2.4 mm. long. Glume and sterile lemma equal, usually 5-nerved, short-pubescent between the nerves. Fertile lemma mostly shorter than the sterile, pale yellow, glabrous or penicillate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5324 (GH). COCHABAMBA: CHAPARE: Locotal, 1500 m., *Steinbach* 9093 in part (GH).

The Steinbach specimen is only an inflorescence-fragment and the present attribution may be an error.

13. *A. iridifolius* (Poepp.) G. A. Black in *Advanc. Front. Pl. Sci.* 5: 125 (1963). Perennial, to 1 m. tall, the culm-nodes densely pubescent. Leaf-sheaths scabrid, carinate, pubescent to long-pilose at the apex; blades flat, to 1.9 cm. wide, obtuse, upper surface scabrid or strigose at base. Inflorescence a terminal panicle of 6-20 distant racemes to 18 cm. long; rachis somewhat flexuose, scabrid. Spikelets to 3 mm. long, greenish to purple. Glume and sterile lemma equal, 4-5-nerved, often puberulent between the nerves. Fertile lemma shorter than the sterile, stramineous, the apex penicillate. LA PAZ: NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 448 (GH).

14. *A. elegantulus* (Presl) Hitchc. in *Contrib. U. S. Nat. Herb.* 24: 433 (1927). Perennial, the culms to 7.5 dm. tall, the nodes glabrous. Leaf-sheaths papillate-pilose to glabrous, papillate-ciliate; blades folded at base, flat above, to 25 cm. long and 5 mm. wide, long-attenuate, papillate-pilose to glabrous. Inflorescence terminal, of up to 12 subdigitate racemes to 10 cm. long; rachis ciliate, with few to no hairs immediately below the spikelets, hairs papillate-based but neither hispid nor golden-brown. Spikelets to 2.5 mm. long, greenish

to purple. Glume and sterile lemma equal, 2-3-nerved, glabrous. Fertile lemma sometimes slightly longer than the sterile, glabrous, shiny brown. LA PAZ: LARECAJA: San Carlos, Mapiri, *Buchtien s. n.* (Black). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7060 (at least as to GH sheet).

15. *A. capillaris* (Lam.) Chase in Proc. Biol. Soc. Wash. 24: 133 (1911). Lax annual, to 7.5 dm. high, nodes glabrous, the lowest sometimes rooting, culms geniculate. Leaf-sheaths ciliate; blades flat, to 8 mm. wide, lanceolate, acuminate, the edges undulate, abruptly rounded and more or less clasping at the base, pilose at the base, the main portion of the blade glabrous or pubescent. Inflorescence terminal, of 2-6 paired or subdigitate racemes to 8 cm. long; rachis and peduncles capillary, the rachis markedly flexuose and scabridulous. Spikelets to 1.6 mm. long, sessile, ellipsoid, obtuse to acute. Sterile lemma and glume equal, with 2-4 inconspicuous nerves, glabrous to sparsely pubescent. Fertile lemma shining, brown, glabrous. LA PAZ: LARECAJA: Mapiri, 1600 m., *Rusby* 241 (GH); Hacienda Simaco, 1400 m., *Buchtien* 5327 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22657 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6879 (GH).

16. *A. Herzogii* (Hack.) Hitchc. in Contrib. U. S. Nat. Herb. 24: 431 (1927). Perennial, to 8 dm. tall, the culm-nodes glabrous. Leaf-sheaths glabrous; blades folded, to 15 cm. long and 3 mm. wide, papillate-ciliate near the base. Panicle of 2-7 subdigitate racemes to 10 cm. long, axis pilose, rachis papillate-ciliate, the hairs yellowish- to golden-brown, long. Spikelet to 2.5 mm. long, lanceolate or lance-ovate, purplish, the pedicels minute. Second glume and sterile lemma equal, 5-nerved, the glume papillate-hispid on the nerves, the sterile lemma with shorter and finer white hairs between the nerves. Fertile lemma nearly as long as the sterile, rather dark brown, obscurely, if at all, striatulate, the acute apex penicillate. SANTA CRUZ: CHIQUITOS: Cerro San Miserate, Santiago, *Herzog* 866 (US; type-number).

17. *A. chrysoblepharis* (Lag.) Chase in Proc. Biol. Soc. Wash. 24: 134 (1911). Annual or perennial, to 10 dm. tall, the culm-nodes glabrous or pubescent. Leaf-sheaths glabrous to densely pubescent, often hispid-ciliate, especially near the apex; blades to 1.5 cm. wide, usually narrower, pilose to glabrous, acuminate. Inflorescence terminal or lateral, of 2-10 racemes to 4 cm. long, subdigitate; rachis not flexuose, the margins and center densely papillate-hispid, the golden or golden-brown hairs dense, to 3-4 mm. long, basally fused, apex often without spikelets. Spikelets to 1.5 mm. long, fitting into cavities in the rachis, ovoid, obtuse. Glume and sterile lemma equal, glabrous, 2-nerved, very thin. Fertile lemma purple or brown, glabrous, obtuse to sub-acute. BENI: YACUMA: Reyes, *Rusby* 216 (Black). LA PAZ: NOR YUNGAS: Hacienda Anacuri, *Holway* 708 (Black).

18. *A. exasperatus* (Nees) G. A. Black in Advanc. Front. Pl. Sci.

5: 168 (1963). Straggling perennial to 8 dm. tall, culms often branched at the base, nodes glabrous. Leaf-sheaths glabrous; blades mostly less than 1 dm. long, to 5 mm. wide, with a few stiff hairs near the base, the apex long-acuminate. Inflorescences terminal, 1-2, of 2-7 racemes to 9 cm. long; rachis somewhat flexuose, papillate-hispid, the hairs golden-brown, with a dense tuft of hairs subtending each spikelet, mostly more than 10 hairs in a tuft. Spikelets to 1.5 mm. long, green to purple, ovoid to obovoid, obtuse to subacute. Glume and sterile lemma equal, the 2-4 nerves obscure, short-pubescent, usually sparsely so, or the hairs in 2 rows. Fertile lemma shining brown, glabrous. SANTA CRUZ: SARA: lomas arenosas, 450 m., [Buenavista ?], *Steinbach* 1815 (GH).

19. *A. chrysites* (Steud.) Kuhl. in Comm. Linh. Telegr. Estrat. Matto Grosse Amazonas, Publ. 67, Anexo 5, Bot. 11: 88 (1922). *A. aureus* of the Catalogue, at least in part. Perennial, straggling to erect, to 7.5 dm. tall, culm-nodes glabrous. Leaves glabrous except for a few hispid hairs at base of upper surface of blade, the blades to 7 mm. wide, attenuate. Inflorescence terminal, 1-2 panicles, the racemes to 8 cm. long; rachis somewhat flexuose, long-hispid on the margins and mid-ridge, with a cluster of hairs to 2.5 mm. long below each spikelet, the hairs yellow- or golden-brown. Spikelets to 1.5 mm. long, obovoid, obtuse, purple to fulvous. Glume and sterile lemma equal, the 2-4 nerves obscure (or absent), glabrous or slightly pubescent. Fertile lemma shining brown, glabrous. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5426 (GH), 6948 (GH).

81. *Paspalum* L.

See Chase in Contrib. U. S. Nat. Herb. 28: 1-310 (1929).

Annual or perennial. Leaf-blades flat or folded at the base. Panicle of 1 to many racemes on a common axis. Rachis of racemes narrow to very broadly winged, sometimes prolonged beyond the ultimate spikelets. Spikelets glabrous or variably pubescent, sessile, sub-sessile or pedicellate, solitary or paired, unilateral on the rachis, often biconvex or planoconvex, disarticulation below the glumes, 2-flowered, the lower floret a sterile lemma, the upper perfect. First glume usually absent, present in some species and occasionally present in others. Second glume usually present, absent in a few species, similar to the sterile lemma in size and appearance. Fertile lemma usually somewhat indurate, often shining, usually somewhat striate or striate-papillate.

a. Rachis prolonged beyond uppermost spikelet.

b. Spikelets glabrous.

c. Glumes absent.

d. Spikelets over 2 mm. long. 4. *P. candidum*.

d. Spikelets less than 2 mm. long.

- e. Culms dark; leaf-sheaths glabrous or sparsely pilose along margins. 5. *P. depauperatum*.
- e. Culms light; leaf-sheaths densely long-pilose. 6. *P. lineispatha*.
- c. Second glume present.
 - f. Spikelets less than 2 mm. long; rachis less than 2 mm. wide.
 - g. Plants over 10 cm. high; leaves sparsely pilose to glabrous. 1. *P. penicillatum*.
 - g. Plants less than 10 cm. high; leaves densely pilose. 2. *P. pygmaeum*.
 - f. Spikelets over 2 mm. long; rachis at least 2 mm. wide. 3. *P. prostratum*.
- b. Spikelets not glabrous.
 - h. Rachis very broadly winged.
 - i. Leaf-blades flat, 3-8 mm. wide; racemes usually more than 1. 7. *P. Ceresia*.
 - i. Leaf-blades very narrow, involute, pilose; racemes rarely more than 1. 8. *P. stellatum*.
 - h. Rachis very narrowly winged. 39. *P. saccharoides*.
- a. Rachis not prolonged beyond uppermost spikelet.
 - j. Spikelets glabrous.
 - k. Glumes absent.
 - l. Rachis puberulent; spikelets mostly over 2 mm. long. 38. *P. boliviense*.
 - l. Rachis glabrous, with a few long cilia; spikelets mostly less than 2 mm. long. 37. *P. malacophyllum*.
 - k. Second glume present.
 - m. Rachis coarsely long-ciliate.
 - n. Rachis sparsely ciliate, mainly puberulent-scabrid; spikelets mostly over 2 mm. long. 32. *P. millegrana*.
 - n. Rachis densely ciliate; spikelets mostly less than 2 mm. long. 33. *P. densum*.
 - m. Rachis not coarsely long-ciliate.
 - o. Racemes not conjugate.
 - p. First glume present on 1 or both of the paired spikelets.
 - q. Spikelets about 1.5 mm. long. 14. *P. decumbens*.
 - q. Spikelets about 2.5 mm. long. 35. *P. pilosum*.
 - p. First glume absent or rarely present on 1 spikelet of the pair. 21. *P. inaequivalve*.
 - o. Racemes conjugate.
 - r. Spikelets about 1 mm. long. 20. *P. pictum*.
 - r. Spikelets 2-3 mm. long.
 - s. Spikelets 2.5-3 mm. long. 25. *P. notatum*.
 - s. Spikelets 2-2.5 mm. long. 26. *P. minus*.
 - j. Spikelets not glabrous.
 - t. Rachis coarsely scabrid-ciliate. 30. *P. virgatum*.

- t. Rachis not coarsely scabrid-ciliate.
- u. Spikelet-hairs swollen-globose. 19. *P. multicaule*.
- u. Spikelet-hairs not swollen-globose.
- v. Spikelets with long silky hairs.
- w. Racemes neither solitary nor conjugate.
- x. Spikelets to 2.5 mm. long. 24. *P. Urvillei*.
- x. Spikelets 3.5 mm. long, or more.
- y. Sterile lemma glabrous.
- z. Racemes 2-5; leaf-blades stiffly pilose (at least on margins). 9. *P. Humboldtianum*.
- z. Racemes 8-16; leaf-blades glabrous or nearly so. 11. *P. Buchtienii*.
- y. Sterile lemma not glabrous.
- aa. Leaf-blades ciliate at base, otherwise glabrous. 23. *P. dilatatum*.
- aa. Leaf-blades puberulent or pilose.
- bb. Blades puberulent on both surfaces. 12. *P. polyphyllum*.
- bb. Blades sparsely to densely pilose. 10. *P. erianthum*.
- w. Racemes solitary or conjugate.
- cc. Racemes solitary. 36. *P. Ekmanianum*.
- cc. Racemes conjugate. 22. *P. conjugatum*.
- v. Spikelets lacking long silky hairs.
- dd. Racemes conjugate (rarely a third raceme present below). 13. *P. distichum*.
- dd. Racemes not conjugate.
- ee. First glume present on 1 of the paired spikelets.
- ff. Plants to 8.5 dm. tall; second glume sometimes puberulent on the margin only. 15. *P. inconstans*.
- ff. Plants to 4.5 dm. tall; second glume obscurely puberulent or pubescent at the summit. 16. *P. lepidum*.
- ee. First glume lacking.
- gg. Spikelets 2 mm. or less in length.
- hh. Fruit dark brown. 27. *P. melanospermum*.
- hh. Fruit pale.
- ii. Sterile lemma pubescent. .. 17. *P. paniculatum*.
- ii. Sterile lemma glabrous. 18. *P. Juergensii*.
- gg. Spikelets over 2 mm. long.
- jj. Fruit pale.
- kk. Leaf-blades densely pubescent on both surfaces. 16. *P. lepidum*.
- kk. Leaf-blades glabrous, scabrous on margins. 34. *P. remotum*.

jj. Fruit dark.

ll. Sterile lemma transversely rugulose near base.
..... 28. *P. plicatulum*.

ll. Sterile lemma not rugulose.

mm. Spikelets to 2.5 mm. long.
..... 29. *P. collinum*.

mm. Spikelets 2.7-3 mm. long.
..... 31. *P. conspersum*.

1. *Paspalum penicillatum* Hook. f. in Trans. Linn. Soc. 20: 171 (1851). Annual, decumbent, to 4 dm. tall. Leaf-blades to 13 cm. long and 1.5 cm. wide, glabrous beneath, sparsely pilose above, ultimately glabrate and somewhat pilose-ciliate near the base. Panicle of several racemes, usually paired, to 3 cm. long, usually nearer 2 cm., the rachis of each raceme extended well beyond the uppermost spikelet, less than 2 mm. wide. Spikelets to 1.7 mm. long, glabrous, second glume present. Sterile lemma as long as spikelet, thin, several-veined. Fertile lemma dull white. LA PAZ: LARECAJA: Sorata, 2650-2800 m., *Mandon* 1250 (GH); Sorata, *Bang* 1310 (GH); Sorata, 2800 m., *Rusby* 240 (GH); NOR YUNGAS: Coripata, 1700 m., *Buchtien* 8050 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22643 (GH).

2. *P. pygmaeum* Hack. in Fedde, Rep. Sp. Nov. 11: 18 (1912). *P. pygmaeum* var. *glabrescens* Hack. in Fedde, Rep. Sp. Nov. 11: 18 (1912). Matted, branched annual, culms to 1 dm. long, usually shorter. Leaf-sheaths rather densely pilose; blades short, usually to 3 cm. long, more sparsely pilose above and beneath. Panicles small, with 2-6 racemes 0.5-2 cm. long, the rachis less than 2 mm. wide, extended beyond the uppermost spikelet. Spikelets less than 2 mm. long, glabrous. Second glume present, 3-nerved, sterile lemma similar, the 3 nerves in a central position. Fertile lemma smooth, not highly shining. LA PAZ: MURILLO: La Paz, 3900 m., *Buchtien* 2490 (GH; type-number of *P. pygmaeum* var. *glabrescens*); Talca Chuquiaguillo, *Bang* 808 (GH). COCHABAMBA: CHAPARE: La Aduana, 3100 m., *Steinbach* 9579 (GH).

3. *P. prostratum* Scribn. & Merr. in U. S. Dept. Agric. Div. Agrost. Bull. no. 24: 9 (1900). Annual, decumbent or prostrate, the culms to 3 dm. long, often rooting at the nodes. Leaf-sheaths sparsely pilose-ciliate or glabrous to densely pilose; blades to 8 cm. long and 1.2 cm. wide, papillate-pilose above and beneath. Panicle of 3-12 solitary to somewhat fasciculate racemes 1-3 cm. long, the rachis about 2.5 mm. wide, extended beyond the uppermost spikelet. Spikelet to 2.2 mm. long, glabrous, second glume present, sterile lemma similar, 3-nerved. Fertile lemma nearly as long as the spikelet, smooth, shining. LA PAZ: LARECAJA: Sorata, *Holway* 507 (US). COCHABAMBA: CERCADO: Morochata, 2900 m., *Cárdenas* 3414 (US).

4. *P. candidum* (Humb. & Bonpl. ex Flüge) Kunth in Mém. Mus. Hist. Nat. 2: 68 (1815). Annual, decumbent, straggling, the culms

often to 1 m. or more in length, the dark nodes somewhat enlarged and strigose to villous. Leaf-sheaths ciliate near the apex, otherwise pilose or glabrous; blades to 12 cm. long and 1.2 cm. wide, finely pilose on both surfaces. Panicle lax, with 7-20 ascending solitary racemes to 4 cm. long, rachis to 2.5 mm. wide, prolonged beyond the uppermost spikelet. Spikelets to 2.5 mm. long, glabrous, both glumes absent. Sterile lemma 3-nerved. Fertile lemma shorter than the sterile, smooth, ivory-white, shining. LA PAZ: SUR YUNGAS: San Felipe, 2800 m., *Hitchcock* 22597 (GH); Sirupaya, 2100 m., *Buchtien* (in *Baenitz Herb. Amer.*) 1408 (GH).

5. *P. depauperatum* Presl, Rel. Haenk. 1: 215 (1830). *P. vinosum* Mez in Fedde, Rep. Sp. Nov. 15: 28 (1917). Decumbent annual, the dark, purplish culms to 1.8 dm. long. Leaf-sheaths glabrous, or, in youth, pilose near the apex, ciliate; blades to 7 cm. long and 4 mm. wide, pilose or papillate-pubescent on both surfaces. Panicle of up to 7 solitary racemes, 15-3 cm. long, the rachis prolonged beyond the uppermost spikelet. Spikelets glabrous, less than 2 mm. long, glumes absent. Sterile lemma 3-veined. Fertile lemma shining. COCHABAMBA: CHAPARE: Incachaca, 2250 m., *Steinbach* 9495 (GH).

6. *P. lineispatha* Mez in Fedde, Rep. Sp. Nov. 15: 27 (1917). Rather straggling annual, the light-colored culms to 30 cm. tall. Leaf-sheaths densely papillate-pilose; blades to 6 cm. long and 9 mm. wide, densely papillate-pilose beneath, sparsely so above. Panicle of 2-12 solitary racemes to 1.5 cm. long, the rachis prolonged beyond the uppermost spikelet, less than 2 mm. wide. Spikelets glabrous, less than 2 mm. long, glumes absent. Sterile lemma 3-veined. Fertile lemma shining. LA PAZ: LARECAJA: Hacienda Casana near Tipuani, 1400 m., *Buchtien* 7112 (GH).

7. *P. Ceresia* (O. Ktze.) Chase in Niles in Contrib. U. S. Nat. Herb. 24: 153 (1925). *P. membranaceum* of the Catalogue. Perennial, to 6 dm. tall, villous at the base, shortly rhizomatous. Leaf-blades to 15 cm. long and 8 mm. wide, pilose near the margin on the upper surface. Panicle of 1-4 distant racemes, the rachis-proper dark, with orange-brown broad margins, to 1 cm. wide overall, prolonged beyond the uppermost spikelet. Spikelets to 4 mm. long, with a dense silver-white pilosity, the longest hairs as long as the spikelet, hairs mostly papillate-based. Second glume present. Without locality: *Bang* 1080 (GH). LA PAZ: LARECAJA: Cerro del Iminapi, 2600-2700 m., *Mandon* 1255 (GH). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5421 (GH).

8. *P. stellatum* Humb. & Bonpl. ex Flüggé, Monogr. Pasp. 62 (1810). Caespitose perennial to 5 dm. tall. Leaf-sheaths densely long-pilose. Inflorescence of 1 arcuate raceme (rarely 2) to 10 cm. long, the broad yellow-brown rachis prolonged beyond the uppermost spikelet. Spikelets to 2.5 mm. long, second glume present; second glume and sterile lemma with very short white hairs and long shining hairs,

these more or less stellate in arrangement. Fertile lemma shorter than the spikelet. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1988 (GH), 7103 (GH).

9. **P. Humboldtianum** Flüge, Monogr. Pasp. 67 (1810). Caespitose perennial to 8 dm. tall, the base rather woody. Leaf-sheaths papillate-pilose, sometimes glabrate; blades flat, to 18 cm. long and 1.5 cm. wide, papillate-pilose or glabrate. Panicle of 2 to several racemes, neither solitary nor conjugate, the narrow rachis not coarsely scabrid-ciliate, not exceeding the uppermost spikelet, usually dull purple. Spikelets mostly purple, to 3.5-4 mm. long. Second glume present, shortly pubescent with appressed hairs, the margins with numerous long papillate-based hairs. Sterile lemma shorter than second glume, glabrous. Fertile lemma dull white, thin-textured. LA PAZ: LARECAJA: Cerro del Iminapi, 2650 m., *Mandon* 1254 (GH). COCHABAMBA: MIZQUE: near Vilavila, 2500 m., *Eyerdam* 24977 (GH); CHAPARE: Locotal, 1900 m., *Steinbach* 9093 in part (GH). SANTA CRUZ: SARA: Cerro del Amboró, 6618 (GH); Buenavista, 450 m., *Steinbach* 6644 (GH); VALLEGRANDE: Cuesta de La Negra, *Steinbach* 3712 (GH).

10. **P. erianthum** Nees in Trin. Gram. Pan. 121 (1826). Perennial, densely caespitose, to 1 m. tall. Leaf-sheaths variably pilose and ciliate; blades sparsely to densely pilose. Panicle of few to several erect racemes, raceme-rachis narrow, not prolonged beyond the uppermost spikelet, not coarsely scabrid-ciliate. Spikelets to 5 mm. long, ovate, acute. Second glume sparsely long-villous, with a marginal fringe of long silky hairs. Sterile lemma more nearly glabrous except at apex. Fertile lemma pale, shining, finely reticulate-striate. SANTA CRUZ: SARA: Buenavista, *Steinbach* 3543 (GH).

11. **P. Buchtienii** Hack. in Fedde, Rep. Sp. Nov. 6: 153 (1908). Caespitose perennial, somewhat straggling, to 10 dm. tall. Leaf-sheaths usually densely long-ciliate, otherwise glabrous; blades to 15 cm. long and 1.5 cm. wide, usually glabrous or glabrate on the upper surface. Panicle of 8-16 purplish racemes to 10 cm. long, neither solitary nor conjugate, the very narrow rachis not extended beyond the uppermost spikelet, not coarsely scabrid-ciliate. Spikelets to 3.5-4 mm. long, second glume present, shortly acuminate, ciliate with a long fringe of stiff white hairs. Sterile lemma glabrous. Fertile lemma shorter than the spikelet. YUNGAS: *Bang* 265 (GH); Puente Villa, 1400 m., *Cárdenas* 3597 (GH). LA PAZ: NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 266 (GH), 447 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22664 (GH); La Florida, 1840 m., *Hitchcock* 22648 (GH).

12. **P. polyphylla** Nees ex Trin. Gram. Pan. 114 (1810). Perennial, to 6 dm. tall. Leaf-sheaths somewhat pilose at the apex, otherwise glabrous; blades to 5 cm. long, about 3 mm. wide, flat to subinvolute, puberulent on both surfaces. Panicle of 1-3 racemes to 7 cm. long, light in color, the narrow rachis not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets to 3.5 mm. long,

second glume present, 5-nerved, densely ciliate with long, stiff, white hairs. Sterile lemma 5-nerved, ciliate on at least the upper margin. Fertile lemma as long as the sterile, thin-textured. SANTA CRUZ: VALLEGRANDE: Cuesta de La Negra, 1500 m., *Steinbach* 3718 (GH); SARA: Buenavista, 500 m., *Steinbach* 5385 (GH), 5762 (GH), 6808 (GH).

13. *P. distichum* L. Syst. Nat. (ed. 10) 2: 855 (1759). Stoloniferous perennial to 6 dm. tall, the nodes pubescent. Leaf-sheaths sparsely hispid-ciliate at the apex, otherwise glabrous; blades subinvolute to flat, to 6 mm. wide, the base sparsely hispid-ciliate, otherwise glabrous. Panicle of 2 conjugate racemes (rarely 3) to 7 cm. long, the rachis not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelets. Spikelets 2.5-3.5 mm. long. First glume often present, but not over 0.5 mm. long; second glume abruptly acute, pubescent to puberulent, the midrib prominent. Sterile lemma similar but glabrous, the midrib prominent. Fertile lemma shorter than spikelet, greenish-white, somewhat shining, often shortly penicillate at the abruptly acute apex. LA PAZ: MURILLO: La Paz, *Buchtien* 4518 (US). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22793 (US). SANTA CRUZ: SARA: Río Surutú, 400 m., *Steinbach* 6835 (GH).

14. *P. decumbens* Swartz, Prodr. 22 (1788). Branched, decumbent perennial, the culms to 6 dm. tall. Leaf-sheaths finely pubescent and densely short-ciliate; blades flat, to 10 cm. long and 8 mm. wide, pubescent on both surfaces, the margins ciliate, at least near the base. Inflorescence a solitary raceme 2-3 cm. long, the narrow rachis not prolonged beyond the uppermost spikelet, not coarsely long-ciliate. Spikelets about 1.5 mm. long, obovate to suborbicular, paired, glabrous. First glume present on one or both spikelets in a pair, very short; second glume rounded, half the length of the spikelet. Sterile lemma similar but usually twice as long. Fertile lemma shining, longitudinally regularly striate, the ridges finely and regularly papillate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5314 (GH). COCHABAMBA: CHAPARE: Antahuacana, Espíritu Santo, 750 m., *Buchtien s. n.* (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7016 (GH). YUNGAS: *Bang* 266 in part (at least as to GH sheet).

15. *P. inconstans* Chase in Contrib. U. S. Nat. Herb. 24: 446 (1927). Perennial, to 8.5 dm. tall, the culms branched above. Leaf-sheaths short-ciliate, pubescent at the apex; blades flat, to 15 cm. long and 1.2 cm. wide, rather densely pubescent on both surfaces. Panicle of 1-8 (usually 2-5) non-conjugate racemes, the narrow rachis not prolonged beyond the uppermost spikelet and not coarsely scabrid-ciliate. Spikelets paired, about 2.5 mm. long. First glume usually present, at least as a rudiment, on the lower of the paired spikelets; second glume shorter than the spikelet, 3(-5)-nerved, the margin puberulent. Sterile lemma somewhat longer, sometimes slightly puberulent on the margin. Fertile lemma somewhat shining, very finely papillate-striate. LA

PAZ: NOR YUNGAS: San José, 1500 m., *Hitchcock* 22734 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22609 (GH).

16. **P. lepidum** Chase in Contrib. U. S. Nat. Herb. 27: 447 (1927). Densely caespitose perennial, to 4.5 dm. tall, the culms simple. Leaf-sheaths pubescent at the apex, otherwise glabrous to pubescent; blades to 11 cm. long and 1 cm. wide, densely pubescent on both surfaces. Panicle of 3-4 non-conjugate racemes, the narrow rachis not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, to 2.4 mm. long. First glume seldom present; second glume 5-nerved, somewhat puberulent or pubescent at the summit. Sterile lemma slightly longer, 5-nerved, glabrous. Fertile lemma very finely papillate-striate. LA PAZ: SUR YUNGAS: San Felipe, 2800 m., *Hitchcock* 22605 (GH).

17. **P. paniculatum** L. Syst. Nat. (ed. 10) 2: 855 (1759). Perennial, branching, to 1 m. or more in height, the culm-nodes pilose to pubescent. Leaf-sheaths glabrous, ciliate; blades flat, to 30 cm. long and 1.5 cm. wide. Panicle of numerous, crowded, non-conjugate racemes, the narrow rachis not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, suborbicular, about 1.2-1.4 mm. long. Second glume present. Sterile lemma pubescent. Fertile lemma minutely papillate-striate. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5323 (GH); NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 269 (GH); Milluguaya, 1300 m., *Buchtien* 269 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22624 (GH).

18. **P. Juergensii** Hack. in Fedde, Rep. Sp. Nov. 7: 312 (1909). Perennial, to 1 m. high, somewhat straggling or decumbent, the nodes dark, often with long hispid hairs. Leaf-sheaths villous-ciliate, often with papillate-based hairs; blades flat, to 20 cm. long and 1.5 cm. wide, long-pubescent above and beneath with papillate-based hairs, or glabrate. Panicle of several lax non-conjugate racemes, rachis of racemes not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, to 1.7 mm. long, second glume present, pubescent, rather blunt. Sterile lemma glabrous. Fertile lemma somewhat shining, very finely papillate-striate. YUNGAS: *Bang* 308 (GH).

19. **P. multicaule** Poir. Encycl. Suppl. 4: 309 (1816). Annual, much-branched from the base, about 1 dm. tall. Leaf-sheaths hispid-ciliate, often pilose; blades narrow, linear, pilose, the margins hispid-ciliate. Panicle of 2 conjugate divergent racemes, rarely 1, or still more rarely 3; raceme-rachis not prolonged beyond the uppermost spikelet, not coarsely scabrid-ciliate. Spikelet suborbicular, 1-1.25 mm. long, second glume present. Glume and sterile lemma with short, clavate to falcate or globose, swollen, transparent, unicellular hairs. Fertile lemma shining, minutely papillate-striate. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 16 (GH).

20. **P. pictum** Ekman in Ark. Bot. 10 (17): 11 (1911). Annual, somewhat tufted, to 3.5 (-5) dm. tall, the nodes glabrous. Leaf-sheaths

glabrous; blades very narrow, linear, flat to conduplicate, scabridulous above, glabrous beneath or with a few papillate-based hispid hairs. Racemes usually 2 (occasionally 1 or 3), somewhat conjugate; raceme-rachis not prolonged beyond the uppermost spikelet, not coarsely long-ciliate. Spikelets obovoid, to 1 mm. long, glabrous, second glume present. Fertile lemma broader than second glume and sterile lemma, markedly papillate-striate at maturity. SANTA CRUZ: SARA: Buena-vista, *Steinbach* 1894 (GH).

21. **P. inaequivalve** Raddi, *Agrost. Bras.* 28 (1823). Perennial, the culms broadly spreading and rooting at the lower nodes. Leaf-sheaths finely pubescent to glabrous, the hairs papillate-based; blades flat, to 25 cm. long and 1.5 cm. wide, cordate-clasping at the base, sparsely pilose above and beneath with papillate-based hairs. Panicle of few to many spreading non-conjugate racemes, the narrow raceme-rachis not coarsely long-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, elliptic, to 2 mm. long. First glume absent or sometimes present on 1 spikelet of the pair, very short; second glume half as long as the spikelet, finely pubescent to glabrous. Sterile lemma finely pubescent or glabrous. Fertile lemma shining, pale green-brown. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22691 (GH).

22. **P. conjugatum** Berg. in *Act. Helv. Phys. Math.* 7: 129 (1762). Perennial, creeping, the flattened culms to 1 m. high, but usually shorter. Leaf-sheaths densely short-ciliate, with an apical ring of long soft hairs; blades flat, to 20 cm. long and 8 mm. wide, the margins shortly scabrid-ciliate, otherwise usually glabrous. Panicle usually of 2 long (10-12 cm.) arcuate, divaricate, conjugate racemes, rarely a third raceme below; raceme-rachis narrow, not coarsely scabrid-ciliate, not extending beyond the uppermost spikelet. Spikelets to 1.5 mm. long, strongly flattened, suborbicular. First glume absent, second glume thin, with a marginal fringe of long silky hairs. Sterile lemma thin, glabrous. Fertile lemma pale, rather shining. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 6325 (GH); NOR YUNGAS: Polo-Polo, 1100 m., *Buchtien* 268 (GH). SANTA CRUZ: SARA: Buena-vista, 450 m., *Steinbach* 1862 (GH), 500 m., *Steinbach* 5160 (GH); Dolores, 450 m., *Steinbach* 6836 (GH).

23. **P. dilatatum** Poir. *Encycl.* 5: 35 (1804). Perennial, to 1.5 m. tall, from a short rhizomatous base. Leaf-sheaths sometimes pilose at the base, otherwise glabrous, ciliate near the apex; blades flat, to 2.5 dm. long and 1.2 cm. wide, the base somewhat ciliate. Panicle usually of 3-5 non-conjugate racemes, the narrow rachis not prolonged beyond the uppermost spikelet, the margin not coarsely scabrid-ciliate. Spikelets to 3.8 mm. long, ovoid, acute. First glume absent, second glume covered with long silky hairs, especially dense along the margin. Sterile lemma slightly shorter than the second glume, the margin not densely silky. Fertile lemma pale, finely papillate-striate. TARIJA: CERCADO: Tarija, 2000 m., *Cárdenas* 202 (GH).

24. *P. Urvillei* Steud. Syn. Pl. Glum. 1: 24 (1854). Stout perennial, to 2.5 m. tall. Leaf-sheaths hirsute, ciliate, or the upper sheaths glabrous; blades to 4.5 dm. long, pilose at the base, otherwise glabrous. Panicle of numerous, ascending, non-conjugate racemes, the raceme-rachis narrow, margin scabrid but not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets to 2.5 mm. long, ovoid, obtuse. Second glume and sterile lemma with many long silky hairs on the margin, the glume sparsely hairy on the back, the lemma glabrous on the back. Fertile lemma pale, smooth or nearly so. LA PAZ: LARECAJA: Sorata, *Gunther* (US).

25. *P. notatum* Flügge, Monogr. Pasp. 106 (1810). Perennial, from a short rhizome, to 5 dm. tall. Leaf-sheaths ciliate at the apex, otherwise glabrous; blades flat, to 3 dm. long and 1 cm. wide, ciliate at the base, otherwise glabrous. Panicle of 2 divergent racemes, conjugate or nearly so (rarely a third raceme present); raceme-rachis narrow, glabrous, not extended beyond the uppermost spikelet. Spikelets unpaired, glabrous, obovoid to ovoid, about 3 mm. long. Second glume present, as long as the sterile lemma, firm-textured. Fertile lemma rather indurate, finely papillate-striate. SANTA CRUZ: SARA: Dolores, 450 m., *Steinbach* 1833 (GH); Buenavista, 450-500 m., *Steinbach* 5273 (GH), 7020 (GH). TARIJA: O'CONNOR: near Entre Rios, 1300 m., *West* 8249 (GH).

26. *P. minus* Fourn. Mex. Pl. 2: 6 (1886). Densely matted perennial, to 3 dm. high. Leaf-sheaths mostly glabrous, long-ciliate. Panicle of 2 conjugate or nearly conjugate racemes (occasionally 3); raceme-rachis narrow, not prolonged beyond the uppermost spikelet, not coarsely scabrid-ciliate. Spikelets solitary, glabrous, to 2.5 mm. long, broadly ovoid, subobtuse. Second glume present, sterile lemma similar but slightly shorter, both with prominent green midribs. Fertile lemma shorter, pale, somewhat shining, finely striate. LA PAZ: LARECAJA: San Carlos, *Buchtien* 79 (US).

27. *P. melanospermum* Desv. in Encycl. Suppl. 4: 315 (1816). Spreading annual, culms to 7 dm. long, the bases decumbent. Leaf-sheaths glabrous; blades flat or folded, to 15 cm. long and 1 cm. wide, pilose at the base on the upper surface, otherwise glabrous. Panicle of 2-7 non-conjugate racemes; raceme-rachis very narrow, not coarsely scabrid-ciliate, not extended beyond the uppermost spikelet. Spikelets usually paired, to 2 mm. long, obovoid. Second glume present, thin, somewhat strigose; sterile lemma thin, the margin wrinkled. Fertile lemma dark-brown and shining, obscurely striate. SANTA CRUZ: SARA: Buenavista, *Steinbach* 5459 (GH).

28. *P. plicatum* Michx. Fl. Bor.-Am. 1: 45 (1803). Perennial, 0.5-1 m. tall. Leaf-sheaths usually glabrous but papillate-hispid on the margins; blades to 5 dm. long and 1 cm. wide, papillate-pilose at the base of the upper surface. Panicle of several to many non-conjugate racemes; raceme-rachis narrow, not coarsely scabrid-ciliate, not

extended beyond the uppermost spikelet. Spikelets paired, to 3 mm. long, obovoid. Second glume present, thin, sparsely appressed-pubescent (occasionally glabrous). Sterile lemma thin, glabrous, transversely rugulose near the base. Fertile lemma dark chestnut-brown, shining, striate. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22675 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1829 (GH), 1869 (GH), 6873 (GH), 6887 bis (GH), 7036 (GH).

29. **P. collinum** Chase in Contrib. U. S. Nat. Herb. 27: 451 (1927). Perennial, to 6.5 dm. tall. Leaf-sheaths glabrous, with a few marginal hairs near the apex; blades flat, to 2 dm. long and 9 mm. wide, rather sparsely long-ciliate. Panicle of 4 distant ascending racemes 2-6 cm. long, the raceme-rachis about 0.7 mm. wide, not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, pedicellate, the pedicels glabrous, to 2.5 (-2.7) mm. long. Second glume shortly appressed-pubescent. Sterile lemma more sparsely pubescent than the glume, 5-nerved. Fertile lemma dark brown, papillate-striate, shining. LA PAZ: NOR YUNGAS: Coroico, 1560 m., *Hitchcock* 22723 (US; type).

30. **P. virgatum** L. Syst. Nat. (ed. 10) 2: 855 (1759). Stout perennial, to 1-2 m. tall. Leaf-sheaths papillate-hirsute on the margins and at the apex; blades flat, to 7.5 dm. long and 2.5 cm. wide, upper surface papillate-hirsute at the base. Panicle of several to many racemes; raceme-rachis narrow, not prolonged beyond the uppermost spikelet, margin scabrid-ciliate, with scattered, long, hispid hairs. Spikelets paired, to 2.5 mm. long, obovoid. Second glume with long silky hairs around margin. Sterile lemma puberulent to glabrous. Fertile lemma shining chestnut-brown, papillate-striate. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 52 (GH); NOR YUNGAS: Hacienda El Choro, Coripata, 1700 m., *Buchtien* 8044 (GH).

31. **P. conspersum** Schrad. ex Schult. Mant. 2: 174 (1817). Perennial, to 1.2 m. tall. Leaf-sheaths glabrous or papillate-pilose; blades sometimes subcordate at the base, flat, sometimes papillate-pubescent on the upper surface. Panicle of several (to 16) non-conjugate racemes; raceme-rachis narrow, the margin scabridulous to scabrid, but without long hispid hairs, not prolonged beyond the uppermost spikelet. Spikelets paired, to 3 mm. long, ellipsoid, acute. Second glume and sterile lemma thin, 5-nerved, one or both shortly pubescent. Fertile lemma chestnut-brown, papillate-striate. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22696 (US).

32. **P. millegrana** Schrad. ex Schult. Mant. 2: 175 (1824). Stout perennial, 1-2 m. tall. Leaf-sheaths glabrous or with a few hairs near the apex; blades folded, to 7.5 dm. long and 1.5 cm. wide, the upper surface often papillate-pubescent. Panicle of several to many non-conjugate racemes to 1.5 dm. long; raceme-rachis coarsely scabrid-serrate and sparsely hispid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, obovoid to suborbicular, glabrous, to

2.5 mm. long. Second glume and sterile lemma firm, 3-nerved. Fertile lemma pale, finely papillate-striate. BENI: YACUMA: Reyes, *Cárdenas* (M. E.) 1656 (Hitchcock).

33. **P. densum** Poir. *Encycl.* 5: 32 (1804). Stout perennial, to 1.2 m. tall. Leaf-sheaths glabrous, or the margin ciliate, or somewhat pubescent to hirsute at the apex; blades folded, often to 1 m. long and 2 cm. wide, but generally shorter and narrower. Panicle of many non-conjugate racemes; raceme-rachis narrow, not prolonged beyond the uppermost spikelet, coarsely scabrid and densely hispid-ciliate. Spikelets paired, suborbicular, to 2.2 mm. long, glabrous. Second glume and sterile lemma 3-nerved, thin. Fertile lemma pale, shining, finely papillate-striate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 3264 (GH), 6898 (GH).

34. **P. remotum** Remy in *Ann. Sci. Nat. (ser. 3) Bot.* 6: 349 (1846). Perennial, decumbent to 10 dm. tall, glabrous. Leaf-blades to 2 dm. long and 1 cm. wide, the margins strongly scabrous. Panicle of 2-5 non-conjugate racemes; raceme-rachis narrow, not coarsely scabrid-ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, to 3.2 mm. long, ovoid. Second glume and sterile lemma green, pubescent, the glume 5-nerved, the lemma 3-nerved. Fertile lemma pale, shining, finely papillate-striate. LA PAZ: LARECAJA: Sorata, *Mandon* 1252 (GH), *Bang* 1312 (GH). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22807 (GH); Mollemolle, 2800 m., *Steinbach* 4055 (GH).

35. **P. pilosum** Lam. *Tabl. Encycl.* 1: 175 (1791). Perennial, somewhat tufted, to 11.5 dm. tall, usually shorter. Leaf-sheaths papillate-pubescent to glabrous, with ciliate margins; blades flat, to 4 dm. long and 8 mm. wide, pubescent above and beneath, margins and base often with papillate-hispid hairs. Racemes solitary, to 15 cm. long, the narrow rachis with few to many papillate-based hispid hairs, not prolonged beyond the uppermost spikelet. Spikelets paired, glabrous, ovoid, to 3 mm. long. First glume small to minute; second glume 5-nerved, firm, shorter than mature fruit. Sterile lemma 5-nerved, firm. Fertile lemma pale, markedly papillate-striate. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 15 (GH).

36. **P. Ekmanianum** Henr. in *Meded. Rijks Herb. Leiden*, no. 40: 49 (1921). Perennial, to 6 dm. tall. Leaf-sheaths ciliate; blades to 1 dm. long, the upper surface papillate-pilose. Racemes solitary (very rarely 2 racemes on a culm), the narrow rachis not prolonged beyond the uppermost spikelet, not coarsely scabrid-ciliate. Spikelets paired, oblong-ellipsoid, to 2 mm. long. Second glume and sterile lemma covered with white hairs of varying lengths, the longest more than twice the length of the spikelet. Fertile lemma pale, rather shining, smooth. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1818 (GH), 5320 (GH), 6923 (GH).

37. **P. malacophyllum** Trin. *Gram. Pan. Icon.* 3: t. 271 (1831). Perennial, to 1-2 m. tall. Leaf-sheaths sparsely papillate-pilose;

blades to 25 cm. long and 2.5 cm. wide, densely to sparsely pubescent beneath. Panicle of numerous non-conjugate racemes; raceme-rachis narrow, sparsely ciliate, not prolonged beyond the uppermost spikelet. Spikelets paired, mostly less than 2 mm. long, often purplish, glabrous. Glumes absent, sterile lemma firm, midrib prominent. Fertile lemma often purplish, strongly ribbed, papillate-striate. LA PAZ: LARECAJA: Hacienda Casana, *Buchtien* 7110 (US).

38. *P. boliviense* Chase in Contrib. U. S. Nat. Herb. 24: 454 (1927). Perennial, 1-1.5 m. high. Leaf-sheaths pubescent or pilose at the base, otherwise glabrous; blades flat, to 2 dm. long and 2 cm. wide, margins scabrid, occasionally a few long hairs near the base, otherwise glabrous. Panicle of numerous non-conjugate racemes; raceme-rachis puberulent, narrow, not prolonged beyond the uppermost spikelet. Spikelets paired, usually purplish, mostly over 2 mm. long, glabrous. Glumes absent. Sterile lemma with a prominent midrib. Fertile lemma strongly 7-nerved, strongly papillate-striate. LA PAZ: LARECAJA: Sorata, *Bang* 1306 (GH; type-number); prope Munaypata, Cerro del Iminapi, 2650 m., *Mandon* 1253 (GH). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22866 (US).

39. *P. saccharoides* Nees in Trin. Gram. Icon. 1: t. 107 (1828). Perennial, stoloniferous, to 1.2 m. high. Leaf-sheaths usually glabrous, sometimes papillate-pilose or papillate, densely ciliate; blades flat, to 3 dm. long and 1.5 cm. wide, the upper surface papillate-pilose, the lower surface glabrous. Panicle of many slender drooping racemes, more or less flabellately arranged; raceme-rachis very narrow, hardly winged, prolonged beyond the uppermost spikelet. Spikelets solitary, distant, lanceolate, acute or acuminate, to 3 mm. long. Second glume often puberulent on the back, marginal fringe of long white hairs, mixed with shorter hairs. Sterile lemma thin, glabrous, shorter than the glume. Fertile lemma thin, not indurate. LA PAZ: LARECAJA: San Carlos, Sarampiuni (Mapiri), 500 m., *Buchtien* 65 (GH); NOR YUNGAS: Coripata, *Hitchcock* 22686 (GH).

82. *Panicum* L.

Annual or perennial; leaf-blades not or barely reaching the inflorescence, rarely exceeding it, linear to lanceolate to elliptic-oblong, acute, glabrous or variously pubescent. Inflorescence a simple to complex panicle, with spikelets from densely racemose on the branches to remote and solitary at the ends of the branchlets. Spikelets pedicellate, disarticulating below the 2 glumes; 2-flowered, the lower floret a sterile lemma (2 sterile lemmas in *P. quadriglume*), or sometimes a staminate floret, the upper floret perfect; fruit indurate or chartaceous-indurate, the lemma-margins inrolled and partly concealing the similar palea.

- a. Inflorescence simple, a central axis with the primary branches densely flowered one-sided racemes.

- b. Primary branches unbranched, short, very densely flowered.
- c. Spikelets hispidulous to hispid.
 - d. Sterile lemma with 2 crateriform glands; fruit not rugose. 16. *P. pulchellum*.
 - d. Sterile lemma glandless; fruit rugose. 1. *P. echinulatum*.
- c. Spikelets glabrous.
 - e. Longest leaf-blades not over 5 cm. long and 2 mm. wide. 14. *P. stoloniferum*.
 - e. Longest leaf-blades 9-15 cm. long and 1.5-2 cm. wide.
 - f. Inflorescence-axis pilose with long hairs; second glume 1.5 mm. long. 11. *P. pilosum*.
 - f. Inflorescence-axis puberulous to short-pubescent, but not pilose; second glume over 2 mm. long. 15. *P. frondescens*.
- b. Primary branches branched, usually from the base, less densely flowered.
 - g. Stem-nodes pubescent to hirsute. 10. *P. polygonatum*.
 - g. Stem-nodes glabrous.
 - h. Longest leaf-blades to 20 cm. long and 1.4 cm. wide, basally cordate and subpetiolate. 13. *P. boliviense*.
 - h. Longest leaf-blades to 10 cm. long and 1 cm. wide, basally not cordate nor subpetiolate. 12. *P. laxum*.
- a. Inflorescence complexly branched, not composed of one-sided racemes; if racemose, the racemes not one-sided and the spikelets not densely crowded.
 - i. Spikelets not solitary at ends of branchlets.
 - j. Spikelets hirsutulous to long-hirsute.
 - k. Spikelets 5.5-7 mm. long; fruit rugose. 29. *P. paucispicatum*.
 - k. Spikelets 4 mm. long or less; fruit not rugose.
 - l. Spikelets long-hirsute, 3.5-4 mm. long. .. 32. *P. procurrens*.
 - l. Spikelets hirsutulous, about 2 mm. long. 26. *P. pantrichum*.
 - j. Spikelets glabrous.
 - m. Primary panicle-branches (except at uppermost nodes) in verticils. 30. *P. megiston*.
 - m. Primary panicle-branches not in verticils (except sometimes at the lowest node only).
 - n. First glume 1 mm. or less. 2. *P. aquaticum*.
 - n. First glume 2-3 mm.
 - o. Leaf-blades to 10 cm. long and 1 cm. wide. 27. *P. cordovense*.
 - o. Leaf-blades to 20 cm. long and 4 mm. wide. 9. *P. tricholaenoides*.
- i. Spikelets remote, solitary at ends of branches, or appearing so.
 - p. Spikelets minutely puberulent to sparsely hispidulous.

- q. Inflorescence-axis glabrous; first glume less than 0.5 mm. long. 17. *P. trichanthum*.
- q. Inflorescence-axis not glabrous; first glume 1-2 mm. long.
 - r. Spikelets 2 mm. long; axis and branches pilose below. 25. *P. sciurotis*.
 - r. Spikelets 3.5 mm. long; axis and branches hirsute-hispid below. 23. *P. Rudgei*.
- p. Spikelets glabrous.
 - s. Spikelets 6-8 mm. long. 31. *P. olyroides*.
 - s. Spikelets less than 5 mm. long.
 - t. Spikelets with 2 sterile lemmas. 7. *P. quadriglume*.
 - t. Spikelets with 1 sterile lemma.
 - u. Fruit rugose or rugulose.
 - v. Second glume to 3.5 mm. long; fertile lemma 2.5 mm. long, rugose. 8. *P. maximum*.
 - v. Second glume 2 mm. long; fertile lemma 2 mm. long, rugulose. 24. *P. Sellowii*.
 - u. Fruit not rugose nor rugulose.
 - w. Leaf-sheaths papillate-pilose.
 - x. Spikelets 3-4 mm. long.
 - y. Spikelets 3.5-4 mm. long, acute; first glume 1 mm. long. 5. *P. stramineum*.
 - y. Spikelets 3 mm. long, acute to acuminate; first glume 1.5-2 mm. long. 6. *P. peladoëense*.
 - x. Spikelets not over 2.5 mm.
 - z. First glume 1.5 mm. long; leaf-blade to 1 cm. wide; fertile lemma about 1.5 mm.
 - A. Leaf-blades pilose above and beneath. 3. *P. cayennense*.
 - A. Leaf-blade glabrous above, pubescent to glabrate beneath. 4. *P. hirticaule*.
 - z. First glume 1 mm. long; leaf-blade to 1.5 cm. wide; fertile lemma about 2 mm. long. 24. *P. hebetes*.
 - w. Leaf-sheaths glabrous; or, if somewhat pubescent, not papillate-pilose.
 - B. Glumes distinctly unequal.
 - C. First glume 1 mm. long; leaf-blades 4 mm. wide, not cordate at base. 19. *P. cyanescens*.
 - C. First glume 0.5 mm. long; leaf-blades to 1 cm. wide, cordate-clasping at base. 20. *P. nervosum*.
 - B. Glumes subequal or nearly so.
 - D. Spikelets viscid-glutinous. 18. *P. glutinosum*.
 - D. Spikelets not viscid-glutinous.
 - E. Leaf-blades about 2 cm. long. 22. *P. parvifolium*.

E. Leaf-blades to 20 cm. long. 28. *P. versicolor*.

1. *Panicum echinulatum* Mez in Notizbl. 7: 62 (1917). *P. echinulatum* var. *boliviense* Henr. in Meded. Rijks Herb. Leiden, no. 40: 50 (1921). Annual, spreading, culms to 3.5 dm. high. Leaf-sheaths pubescent along the margins, otherwise glabrous; blades lanceolate, acute, to 11 cm. long and 1.4 cm. wide, firm-textured, the thickened margins undulate and ciliolate, glabrous above and beneath. Panicles less than 10 cm. long, axis, branches and pedicels glabrous, scabridulous on the margins. Spikelets to 4 mm. long, usually about 3.5 mm., acute, hispid. Glumes very unequal; first glume broadly ovate, abruptly acute, to 1.5 mm. long, 3-nerved; second glume 3.5 mm. long, acute, 5-nerved. Sterile lemma as long as second glume and similar in appearance. Fertile lemma shorter than the sterile lemma, sub-obtuse, indurate, transversely rugose. TARIJA: ENTRE RIOS: Villa Montes, *Pflanz* 607 (Hitchcock). SANTA CRUZ: CERCADO: Santa Cruz, 450 m., *Steinbach* 5259 (GH).

2. *P. aquaticum* Poir. Encycl. Suppl 4: 281 (1816). Perennial, often decumbent and spreading, in wet places or actually in water, the culms to 10 dm. tall. Leaf-sheaths glabrous, the lance-linear blades to 25 cm. long and 1 cm. wide, acute, glabrous. Panicle to 25 cm. long at maturity, the branches somewhat erect but spreading, axis, branches and pedicels glabrous, their margins sometimes scabridulous. Spikelets glabrous, acute, to 3 mm. long. Glumes quite unequal; first glume 1 mm. long, or less, truncately acute, broadly clasping at the base, 1-nerved; second glume 3 mm. long, acute, about 9-nerved. Sterile lemma similar to second glume, slightly shorter and fewer-nerved. Fertile lemma about 2 mm. long, acute, shining, longitudinally striatulate. SANTA CRUZ: SARA: Buenavista, *Steinbach* 3180 (GH).

2a. *P. aquaticum* var. *chloroticum* (Nees ex Trin.) R. C. Foster, comb. nov. *P. chloroticum* Nees ex Trin. Gram. Pan. 236 (1826). Sympatric with and similar in all respects to *P. aquaticum* except for smaller spikelets, 2-2.5 mm. long. BENI: YACUMA: Reyes, *Rusby* (M. E.) 1636 (US).

3. *P. cayennense* Lam. Encycl. Tabl. 1: 173 (1791). Annual, erect, the culms to 5 dm. tall. Leaf-sheaths papillate-pilose, the linear blades to 16 cm. long and 1 cm. wide, pilose above and beneath. Panicles to 20 cm. long, rather open, the axis hispid-pilose, branches and pedicels glabrous, the margins scabridulous. Spikelets to 2.5 mm. long, usually a little less, glabrous, somewhat acute. Glumes unequal; first glume nearly 1.5 mm. long, acute, 5-nerved; second glume a little over 2 mm. long, acute, 7-nerved. Sterile lemma as long as second glume, 5-nerved. Fertile lemma 1.5 mm. long, obtuse, firm, longitudinally striatulate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6935 (GH).

4. *P. hirticaule* Presl, Rel. Haenk. 1: 308 (1830). Annual, spread-

ing, the culms usually less than 5 dm. tall. Leaf-sheaths variably hispid, but mostly papillate-pilose, the blades lance-linear, to 15 cm. long and 8 mm. wide, variably hispid to pubescent or glabrate beneath. Panicle open, to 15 cm. long, usually shorter, axis and main branches sparsely long-hispid, branchlets and pedicels scabridulous on the margins. Spikelets about 2.5 mm. long, acute, glabrous. Glumes unequal; first glume 1.5 mm. long, acute, 3-5-nerved, the nerves not anastomosing; second glume about 2.5 mm. long or a little shorter, 7-nerved. Sterile lemma about 2.5 mm. long. Fertile lemma about 1.5 mm. long, shining, warm brown, longitudinally striatulate. BENI: CERCADO MOJOS: Trinidad, 200 m., *Cárdenas* 3534 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7086 bis (GH).

5. *P. stramineum* Hitchc. & Chase in Contrib. U. S. Nat. Herb. 15: 67 (1910). Annual, erect or spreading, the culms to 5 dm. tall but usually shorter. Leaf-sheaths usually papillate-pilose, but sometimes almost glabrous, the lance-linear blades to 20 cm. long and 8 mm. wide, glabrous to sparsely pilose, at least beneath, the margins sparsely long-ciliate to glabrous. Panicle open, about 15 cm. long, axis, branches and pedicels glabrous but scabridulous on the margins. Spikelets 3.5-4 mm. long, glabrous, acute. Glumes very unequal; first glume about 1 mm. long, obtuse or abruptly acute, 3-5-nerved, the nerves anastomosing; second glume 3 mm. long, acute, many-nerved. Sterile lemma as long as or slightly longer than the second glume, subobtuse, many-nerved. Fertile lemma about 2.5 mm. long, shining, firm-textured. BENI: YACUMA: Reyes, *Cárdenas* (M. E.) 1647 (US).

6. *P. peladoëense* Henr. in Blumea, 4(3): 504 (1941). Perennial, to 4 dm. tall. Leaf-sheaths papillate-pilose; blades scabridulous-puberulent above and beneath, sparsely papillate-hirsute above and beneath, the long hairs hispid, blade to 4 mm. wide. Panicle to 12 cm. long, axis and branches glabrous, branchlets and pedicels scabridulous. Spikelets glabrous, acute to acuminate, 3 mm. long. Glumes unequal; first glume ovate, 1.5-2 mm. long, subacute, 5-nerved; second glume 2.5-3 mm. long, 5-nerved, acute. Sterile lemma about 3 mm. long, or slightly longer, acute to acuminate. Fertile lemma about 2 mm. long, dark-brown, shining, obtuse. SANTA CRUZ: VALLEGRANDE: Cuesta de los Monos, 1400 m., *Herzog* 1896j (cited in original description; not seen).

The only material of this species which has been seen is an isotype, *Balansa* 4357, in the United States National Herbarium. The description is based entirely on this. Since no Bolivian material has been seen in two large herbaria, it is possible that the attribution of the species to Bolivia rests on a misdetermination.

7. *P. quadriglume* (Doell) Hitchc. in Contrib. U. S. Nat. Herb. 24: 460 (1927). Perennial, the culms to 4 dm. tall, the nodes densely

pilose. Leaf-sheaths papillate-pilose, blades to 20 cm. long and 5 mm. wide, linear, pilose above and beneath. Panicle rather open at maturity, to 15 cm. long, axis, branches and pedicels glabrous, the branches and pedicels scabridulous on the margins. Spikelets to 3 mm. long, glabrous, acute, with 2 sterile lemmas. Glumes unequal; first glume 1.5 mm. long, broad, acute, 5-nerved, the lateral nerves more or less anastomosing; second glume 2.5 mm. long, 7-nerved. Sterile lemmas 3 mm. long, about 7-nerved. Fertile lemmas about 2 mm. long, firm-textured, shining, dark brown (paler in immaturity). LA PAZ: NOR YUNGAS: Milluguaya, 1100 m., *Buchtien* 4174 (GH). SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5299 (GH), 7076 bis (GH), 6979 (at least as to GH sheet).

8. *P. maximum* Jacq. Coll. Bot. 1: 76 (1786). Perennial, to 2 m. tall, culms with pubescent to somewhat hirsute nodes. Leaf-sheaths glabrous to sparsely papillate-hirsute, blades to 30 cm. long and 7 mm. wide, linear, glabrous above and beneath. Panicle open, to 3.5 dm. long, axis, branches and pedicels glabrous, the branches often shortly pubescent at the very base. Spikelets to 3.5 mm. long, glabrous, acute. Glumes unequal; first glume 1.5 mm. long, rather obtuse, obscurely nerved; second glume to 3.5 mm. long, about 7-nerved, the nerves rather obscure. Sterile lemma about as long as the second glume, 7-nerved. Fertile lemma 2.5 mm. long, strongly rugose, the apex often minutely puberulent. LA PAZ: NOR YUNGAS: Milluguaya, 1200 m., *Buchtien* 442 (in 1917) (GH); Polo-Polo, near Coroico, 1100 m., *Buchtien* 442 (in 1912) (GH).

9. *P. tricholaenoides* Steud. Syn. Pl. Glum. 1: 68 (1854). ? *P. giganteum* O. Ktze. Rev. Gen. 3(2): 360 (1898). Perennial, slender, erect, rhizomatous, the culms to 1 m. tall. Leaf-sheaths glabrous, the glabrous linear blades to 20 cm. long and 4 mm. wide, often inrolled. Panicle rather narrow, to 20 cm. long, the branches erect to rather spreading, axis glabrous, branches scabrid on the margins, the ultimate pedicels often ciliate with long stiff hairs, a group of such hairs often subtending the spikelets. Spikelets to 3 mm. long, glabrous, acute. Glumes unequal; first glume to 2 mm. long, rather narrowly acute, 3-nerved; second glume as long as the spikelet, 5-7-nerved. Sterile lemma shorter than second glume, obscurely nerved. Fertile lemma less than 2 mm. long, somewhat obtuse, shining, firm. SANTA CRUZ: SARA: Buenavista, campos de Dolores, 450 m., *Steinbach* 3220 (GH).

10. *P. polygonatum* Schrad. ex Schult. Mant. 2: 256 (1824). Perennial, somewhat sprawling, the culms 2-6 dm. tall, the nodes pubescent to hirsute. Leaf-sheaths ciliate, the lanceolate blades to 20 cm. long and 2 cm. wide, pilose above and beneath, at least when young, long-acute, the base subcordate and often subpetiolate. Panicle spreading, to 2.5 dm. long, the spikelets unilateral on the branches, the axis and branches scabridulous and sparsely hispid, the pedicels scabri-

dulous. Spikelets about 1.5 mm. long, acute, glabrous. Glumes unequal; first glume 1 mm. long, 1-nerved, the nerve apically scabridulous, acute; second glume as long as the spikelet, 5-nerved. Sterile lemma shorter than second glume, about 3-nerved. Fertile lemma 1 mm. long or slightly longer, acute, shining. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5334 (GH); San Carlos, Mapiri, 850 m., *Buchtien* 74 (GH). SANTA CRUZ: SARA: Buenavista, 400 m., *Steinbach* 5231 (GH); Río Surutú, 500 m., *Steinbach* 6840 (GH).

11. *P. pilosum* Swartz, Prodr. 22 (1788). Spreading to ascending perennial, the culms to 6 dm. tall. Leaf-sheaths long-ciliate on the margins, otherwise glabrous to slightly pilose, the broadly linear blades to 15 cm. long and 1.5 cm. wide, usually glabrous beneath, scattered-pilose above, acute, abruptly rounded at the base. Panicle to 15 cm. long, the main axis glabrous or somewhat puberulent, the primary branches with long stiff hairs much exceeding the spikelets, pedicels glabrous to subpuberulous, the component racemes short (seldom more than 3 cm. long), densely flowered, ascending to somewhat spreading, usually arranged in verticils. Spikelets about 1.5 mm. long, sub-acute. Glumes unequal; first glume 1 mm. long, 3-nerved; second glume as long as the spikelet, 5-nerved. Sterile lemma like second glume, but sometimes slightly shorter, rather blunt, obscurely 5-nerved. Fertile lemma shorter than sterile, indurate, shining. LA PAZ: LARECAJA: San Carlos, Mapiri, 750 m., *Buchtien* 78 (GH).

12. *P. laxum* Swartz, Prodr. 23 (1788). Perennial, basally decumbent or spreading, culms 2-6 dm. tall. Leaf-sheaths densely ciliate, blades to 10 cm. long and 1 cm. wide, lanceolate, acute, the base abruptly contracted, glabrous above and beneath. Panicle fairly open, to 2 dm. long, the branches spreading and branched, the numerous spikelets unilaterally arranged, axis, branches and pedicels glabrous but the margins scabridulous. Spikelets to 1.5 mm. long, acute, glabrous. Glumes unequal; first glume less than 1 mm. long, 1-nerved, acute; second glume as long as the spikelet, 5-nerved. Sterile lemma as long as second glume, several-nerved, rather obtuse. Fertile lemma about 1 mm. long, shining. YUNGAS: *Bang* 308a (GH). LA PAZ: LARECAJA: Charopampa, 570 m., *Buchtien* 1168 (GH); San Carlos, 750 m., *Buchtien* 1179 (GH); Hacienda Simaco, 1400 m., *Buchtien* 5315 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 2064 (GH), 5161 (GH), 5338 (GH), 6850 (GH); VALLEGRANDE: Comarapa, Yungas de San Mateo, 2500 m., *Steinbach* 8508 (GH).

13. *P. boliviense* Hack. in Fedde, Rep. Sp. Nov. 11: 19 (1912). Perennial, decumbent to spreading, the culms to 3-5 dm. tall. Leaf-sheaths ciliate, blades lanceolate to lance-oblong or occasionally lance-linear, to 20 cm. long and 1.4 cm. wide, rather long-acute, the base cordate to subcordate and subpetiolate, glabrous above and beneath. Panicle quite open at maturity, to 20 cm. long, axis, branches and pedicels often scabridulous on the margins, the lower primary branches

sometimes sparsely hispid in the axils, the spikelets more loosely arranged than in *P. laxum*. Spikelets 1.5 mm. long, acute or subobtuse, glabrous. Glumes unequal; first glume about 0.75 mm. long, 1-nerved or rather obscurely 3-nerved; second glume as long as the spikelet, 5-nerved. Sterile lemma as long as second glume, 5-nerved, subobtuse. Fertile lemma slightly longer than 1 mm., subobtuse, not markedly shining but rather dull, obscurely 3-nerved, longitudinally striatulate. SANTA CRUZ: SARA: Buenavista, 400-450 m., *Steinbach* 6857 (US, GH), 6944 bis (GH). COCHABAMBA: CHAPARE: Antahuacana, *Buchtien* 2501 (US; type-number).

14. *P. stoloniferum* Poir. *Encycl. Suppl.* 4: 274 (1816). Perennial, creeping and spreading, the flowering culms to 3 dm. tall. Leaf-sheaths pubescent, at least sparsely so, blades lanceolate, to 3.5-4 cm. long and 5 mm. wide, puberulent above and beneath, at least when young, acute, abruptly narrowed at the base and usually subpetiolate. Panicle small, occasionally to 5 cm. long, the component racemes seldom over 1 cm. long, axis glabrous or nearly so, branches and pedicels glabrous to somewhat puberulous. Spikelets 2.5-3 mm. long, acute, glabrous. Glumes very unequal; first glume 1 mm. long, or slightly longer, 3-nerved, the central nerve prominent; second glume 2.5 mm. long, 5-nerved. Sterile lemma about 3 mm. long, 5-nerved. Fertile lemma 1.5 mm. long, indurate, shining, acute, obscurely nerved, not rugose. LA PAZ: LARECAJA: Mapiri, *Buchtien* 1167 (US).

15. *P. frondescens* Meyer, *Frimit. Fl. Esseq.* 56 (1818). Annual (?), decumbent, rooting at the nodes, the flowering culms to 3 or even 5 dm. tall. Leaf-sheaths ciliate, blades to 9-10 cm. long and 2 cm. wide, lance-ovate, acuminate, the wide base abruptly narrowed and shortly petiolate, scabridulous above and beneath. Panicles to 13 cm. long, main axis puberulent to pubescent, branches and pedicels glabrous. Spikelets to 3 mm. long, usually shorter, acute, glabrous. Glumes very unequal; first glume 1 mm. long, broadly ovate, abruptly acute, rather obscurely 3-nerved, the midrib scabridulous above; second glume to 2.25 mm. long, shorter than the spikelet, acute, 5-nerved. Sterile lemma similar to second glume but 2.5-3 mm. long. Fertile lemma about 1.5 mm. long, narrow, acute, indurate, shining, smooth. LA PAZ: NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* 264 (GH), 1173 (GH). SANTA CRUZ: SARA: Buenavista, 400 m., *Steinbach* 5130 (GH), 6855 (GH).

16. *P. pulchellum* Raddi, *Agrost. Bras.* 42 (1823). Slender spreading perennial, the flowering culms to 2-3 dm. tall. Leaf-sheaths shortly ciliate, the blades lance-ovate, to 6 cm. long and 1.7 cm. wide, basally subcordate, glabrous above, sometimes sparsely puberulent beneath. Panicle to 10-11 cm. long, the branches remote, axis and branches sparsely pubescent to hispidulous, the pedicels mostly glabrous. Spikelets to 2.5 mm. long, from nearly glabrous to hispidulous or hispid, acute. Glumes unequal; first glume 1 mm. or slightly less,

ovate, acute, 3-nerved; second glume 2 mm. long, ovate, acute, 5-nerved. Sterile lemma about 2 mm. long, long-acute, 5-nerved. Fertile lemma 1.5 mm. long, chartaceous, shining, not rugose. LA PAZ: SUR YUNGAS: Guanay, *Rusby* 217 (US).

17. *P. trichanthum* Nees, Agrost. Bras. 210 (1829). Straggling perennial, the culms to 1 m. tall. Leaf-sheaths long-ciliate, otherwise glabrous, blades to 15 cm. long and 2 cm. wide (rarely wider), sparsely to densely pubescent above and beneath, at least when young, lanceolate, acute, basally abruptly rounded and somewhat clasping. Panicle large, diffuse, to 20 cm. long, axis, branches and pedicels glabrous. Spikelets minutely puberulous to glabrous, solitary, to 1.5 mm. long. Glumes very unequal; first glume less than 0.5 mm. long, white-papery, not obviously nerved; second glume as long as the spikelet, 5-nerved. Sterile lemma as long as second glume and similar in appearance. Fertile lemma less than 1.5 mm. long, indurate, not rugose, shining. LA PAZ: NOR YUNGAS: Coroico, *Buchtien* 445 (GH), 446 (US); SUR YUNGAS: Chulumani, *Hitchcock* 22660 (US). SANTA CRUZ: CORDILLERA: Puerto Suarez, *Agnes Chase* 11155 (GH).

18. *P. glutinosum* Swartz, Prodr. 24 (1788). Perennial, to 1-2 m. tall, decumbent at the base. Leaf-sheaths glabrous with a hispid collar at the apex, the blades to 30 cm. long and 2.5 cm. wide, the margins hispid-ciliate, especially at the base, otherwise glabrous or glabrescent. Panicle open, to 3 dm. long, axis, branches and pedicels glabrous, or the margins finely scabridulous. Spikelets glutinous, subobtuse, to 3-3.5 mm. long. Glumes approximately equal; first glume 2.25 mm. long, broad, 5-nerved, obtuse; second glume about 2.5 mm. long, 7-nerved, obtuse. Sterile lemma 3 mm. long, 5-nerved. Fertile lemma 2.5 mm. long, firm-textured, minutely puberulent at the apex. LA PAZ: LARECAJA: Mapiri, 830 m., *Rusby* 244 (GH); Hacienda Simaco, near Tipuani, 1400 m., *Buchtien* 5316 (GH). SANTA CRUZ: SARA: Monte del Fraile, Buenavista, 450 m., *Steinbach* s. n. (GH).

19. *P. cyanescens* Nees, Agrost. Bras. 220 (1829). Slender perennial, the culms to 6 dm. tall. Leaf-sheaths glabrous, sparsely hispid-pilose at the apex, the linear blades mostly less than 10 cm. long, 4 mm. wide, glabrous above and beneath. Panicle diffuse, less than 10 cm. long, axis, branches and pedicels glabrous. Spikelets to 2 mm. long, ovoid, glabrous. Glumes unequal; first glume 1 mm. long, sub-obtuse, 1-nerved, with 2 obscure lateral nerves; second glume 1.5 mm. long, obtuse, 5-nerved. Sterile lemma slightly over 1 mm. long, obscurely nerved. Fertile lemma 1.5 mm. long, shining, longitudinally striatulate. SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5175 (GH), 6940 in part (GH).

20. *P. nervosum* Lam. Encycl. 4: 747 (1798). Perennial, the culms 3-6 dm. tall. Leaf-sheaths somewhat hispid-ciliate, otherwise glabrous, the blades to 8-9 cm. long and 1 cm. wide, glabrous above and beneath, acute, cordate-clasping. Panicle diffuse, to 12-15 cm. long, axis,

branches and pedicels glabrous. Spikelets about 1.5 mm. long, glabrous, rather narrowly ovoid, subobtuse. Glumes markedly unequal; first glume 0.5 mm. long, obtuse to subacute, obscurely nerved; second glume 1.5 mm. long, obscurely 7-nerved. Sterile lemma slightly shorter than second glume, or equal to it. Fertile lemma slightly over 1 mm. long, subacute, shining, longitudinally striatulate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1213 (GH); CERCADO: bañado de Piray, 450 m., *Steinbach* 1980 (GH).

21. *P. Sellowii* Nees, *Agrost. Bras.* 153 (1829). Perennial, spreading, the culms to 1 m. tall. Leaf-sheaths ciliate, pubescent to pilose, often glabrate with age, the lance-linear blades to 20 cm. long and 2 cm. wide, pilose above and beneath, or glabrate with age, acute, the base often abruptly rounded and subpetiolate. Panicle very open at maturity, to 15 cm. long, the branches remote and with the relatively few spikelets along the upper half on slender pedicels, axis and branches sparsely pilose below, pedicels and upper branches scabridulous. Spikelets 2-2.5 mm. long, glabrous. Glumes unequal; first glume to 1.5 mm. long, acute, 1-nerved; second glume 2 mm. long, 5-nerved, subacute. Sterile lemma to 2.5 mm. long, obscurely 5-nerved. Fertile lemma about 2 mm. long, shining, transversely rugulose. LA PAZ: LARECAJA: San Carlos, near Mapiri, 850 m., *Buchtien* 53 (GH); Hacienda Simaco, 1400 m., *Buchtien* 5317 (GH); NOR YUNGAS: Bella Vista, *Hitchcock* 22752 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22638 (GH). COCHABAMBA: CHAPARE: Locotal, 1600 m., *Steinbach* 9095 (GH).

22. *P. parvifolium* Lam. *Encycl. Tabl.* 1: 173 (1791). Straggling perennial, the culms to 3 dm. tall. Leaf-sheaths glabrous, the blades about 2 cm. long and 5 mm. wide, pilose above and beneath, occasionally glabrous, lanceolate, acute, cordate or subcordate at the base. Panicle open, to 5 cm. long, axis, branches and pedicels glabrous. Spikelets about 1.5 mm. long, glabrous, more or less elliptic-ovoid, obtuse. Glumes somewhat unequal; first glume a little over 1 mm. long, 3-nerved; second glume 1.5 mm. long, 5-nerved, subacute. Sterile lemma as long as second glume, 5-nerved, obtuse. Fertile lemma slightly over 1 mm. long, longitudinally striatulate, shining. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6646 (GH), 6865 (GH), 7011 (GH), 6940 in part (GH).

23. *P. Rudgei* Roem. & Schult. *Syst. Veg.* 2: 444 (1817). Tufted perennial, the often flexuose culms to 1 m. tall. Leaf-sheaths densely papillate-pilose, blades more or less linear, acute, to 30 cm. long and 8 mm. wide, equaling the inflorescence, puberulent to pubescent above, pubescent to short-pilose beneath. Panicle large, to 3-4 dm. long, the branches erectly spreading, the axis hirsute-hispid below, glabrous above, branches scabridulous on margins, spikelets remote and solitary at ends of branches. Spikelets to 3.5 mm. long, at least the first glume somewhat hispid. Glumes unequal; first glume 2 mm. long,

5-nerved, very acute, hispid on upper portion; second glume 3 mm. long, 5-nerved, mostly glabrous. Sterile lemma 3 mm. long, glabrous, 7-nerved. Fertile lemma to 2.5 mm. long, obtuse, indurate, shining, longitudinally striatulate. LA PAZ: LARECAJA: San Carlos, 950 m., *Buchtien* 32 (GH).

24. *P. hebotes* Trin. in Mém. Acad. St. Pétersb. (ser. 6) Sci. Nat. 1: 301 (1834). Perennial, the culms to 6.5 dm. tall. Leaf-sheaths papillate-pilose, the lanceolate blades to 15 cm. long and 1.5 cm. wide, pilose above and beneath, acute, basally cordate. Panicle rather diffuse, to 15 cm. long, axis densely pilose, primary branches more sparsely pilose below, glabrous above, branchlets and pedicels glabrous. Spikelets 2 mm. long, acute, glabrous. Glumes unequal; first glume 1 mm. long, acute, 3-nerved, sometimes obscurely so; second glume 2 mm. long, acute, 9-nerved. Sterile lemma slightly longer than the second glume, about 7-nerved. Fertile lemma slightly less than 2 mm. long, subacute. YUNGAS: *Bong* 493 in part (at least as to GH sheet).

25. *P. sciurotis* Trin. Gram. Pan. 228 (1826). Slender perennial, caespitose, culms to 4 dm. tall, rarely to 6 dm. Leaf-sheaths pubescent, blades lanceolate, to 7 cm. long and 1.2 cm. wide, puberulent above and beneath, acute, the base abruptly cordate-clasping. Panicle much-branched, usually less than 10 cm. long, the branching fine, axis and branches pilose below, glabrous above, pedicels glabrous. Spikelets solitary, to 2 mm. long, minutely puberulous to glabrous. Glumes unequal; first glume 1 mm. long, acute, 1-nerved; second glume 1.5 mm. long, subobtuse, 5-nerved. Sterile lemma nearly 2 mm. long, 7-nerved, subobtuse. Fertile lemma 1.5 mm. long, acute, shining, more or less indurate. LA PAZ: SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22669 (GH), 22709 (GH).

26. *P. pantrichum* Hack. in Verh. Zool. Bot. Ges. Wien, 1915: 72 (1915). Spreading perennial, lower nodes rooting, culms 2-3 dm. tall, but usually shorter. Leaf-sheaths somewhat papillate-pilose, blades lanceolate, to 7-8 cm. long and 8 mm. wide, acute, puberulent above and beneath. Mature panicle spreading, to 15 cm. long, axis and branches scabridulous, the long pedicels puberulent to scabridulous. Spikelets 2 mm. long, or a little longer, hirsutulous to nearly glabrous, ovoid, obtuse. Glumes unequal; first glume 1.5 mm. long, 3-nerved; second glume as long as the spikelet, 5-nerved. Sterile lemma as long as the spikelet, 5-nerved. Fertile lemma indurate, smooth, shining, sometimes obscurely striatulate. LA PAZ: LARECAJA: Mapiri, *Buchtien* 1171 (US).

27. *P. cordovense* Fourn. Mex. Pl. 2: 26 (1886). Perennial, straggling, culms to 20 cm. tall. Leaf-sheaths papillate-pilose, densely ciliate, the blades to 10 cm. long and 1 cm. wide, lanceolate, acute, glabrous. Panicle to 15 cm. long, axis, branches and pedicels glabrous. Spikelets to 3-3.5 mm. long, acute, glabrous. Glumes somewhat un-

equal; first glume about 3 mm. long, 3-nerved; second glume as long as the spikelet, abruptly acute, 7-nerved. Sterile lemma slightly shorter than second glume, 7-nerved, obtuse. Fertile lemma about as long as the sterile, obtuse, rather indurate, shining. LA PAZ: SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22647 (GH).

28. **P. versicolor** Doell in Mart. Fl. Bras. 2(2): 254 (1877). Perennial, shortly rhizomatous, erect, the culms to 6 dm. tall. Leaf-sheaths hirsute-ciliate, otherwise sparsely pubescent to glabrous, the linear blades to 20 cm. long and 8 mm. wide, pubescent to glabrous or glabrate. Panicle open, to 10-15 cm. long, axis, branches and pedicels glabrous. Spikelets 2.5 to nearly 3 mm. long, glabrous, asymmetric, racemose on remote slender pedicels along the upper portion of branches, appearing solitary at ends of branchlets. Glumes nearly equal; first glume 1 mm. long, subacute to obtuse, obscurely 3-nerved; second glume slightly over 1 mm. long, about 5-nerved. Sterile lemma about 2.5 mm. long, containing a staminate floret, winged, splitting at maturity. Fertile lemma 2 mm. long, dark brown, shining, with a marked dorsal ridge. SANTA CRUZ: SARA: Río Dolores, *Steinbach* 3542 (GH); Buenavista, 450 m., *Steinbach* 6643 (GH), 6656 (GH).

29. **P. paucispicatum** Morong in Ann. N. Y. Acad. 7: 262 (1893). Coarse perennial, to 1 m. high, usually less, the culms pubescent. Leaves oblong to lanceolate, acute, to 6.5 cm. long and 1.5 cm. wide, densely short-pubescent and ciliate, blades flat. Panicle about 10 cm. long, few-branched, axis, branches and pedicels densely puberulent, the pedicels with an apical collar of long stiff hairs subtending the spikelet. Spikelets fusiform, acuminate, hirsutulous, 5.5-7 mm. long. Glumes unequal, hirsutulous; first glume about 3 mm. long, strongly 5-nerved; second glume as long as the spikelet, strongly 7-nerved. Sterile lemma 5-7 mm. long, hirsutulous above, sparsely so below, about 5-nerved. Fertile lemma indurate, rugose, abruptly acute and subrostrate. SANTA CRUZ: CERCADO: Palmar, *Herzog* 1524 (US).

30. **P. megiston** Schult. Mant. 2: 248 (1824). Stout perennial, creeping at the base, the culms to 1-2 m. tall. Leaf-sheaths sparsely papillate-pilose, the blades lanceolate, to 40 cm. long and 3 cm. wide, long-acute, glabrous above and beneath. Panicle to 6 dm. long, spreading, the primary branches in distant verticils (usually opposite or alternate at the uppermost node), axis hispid at the nodes, otherwise glabrous, branches and pedicels scabridulous on the margins. Spikelets glabrous, to 4 mm. long, broadly ovoid, abruptly acute, usually solitary or in groups of 2 along the branches. Glumes very unequal; first glume about 1.5 mm. long, abruptly subacute, strongly 3-nerved, broader than long and basally completely clasping; second glume about 3.5 mm. long, abruptly acute, 9-11-nerved. Sterile lemma about 3 mm. long, subobtuse, 7-nerved. Fertile lemma about 3 mm. long, abruptly acute, indurate, shining. LA PAZ: CAUPOLICÁN: Ixiamas, *White* (M. E.) 1135 (*Hitchcock*).

31. *P. olyroides* HBK. Nov. Gen. & Sp. 1: 102 (1816). Erect perennial, the culms to 10 dm. tall. Leaf-sheaths markedly imbricate, glabrous, the linear firm blades to 30 cm. long and 8 mm. wide, glabrous above and beneath. Panicle open, to 3 dm. long, the axis, branches and pedicels densely scabrid-ciliate, the few spikelets on long slender pedicels near the branch-ends. Spikelets 6-8 mm. long, glabrous, fusiform, long-acute. Glumes unequal; first glume to 6 mm. long, long-acute, 5-7-nerved; second glume to 8 mm. long, long-acute, about 9-nerved, with 2 internal basal tufts of subhispid hairs. Sterile lemma to 3.5 mm. long, acute, the nerves prominent near the apex only. Fertile lemma to 3.5 mm. long, obtuse, shining, the base with 2 lateral patches of short, white, crispate hairs. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5378 (GH), 6978 (GH).

32. *P. procurrens* Nees ex Trin. Gram. Pan. 183 (1826). Decumbent perennial, spreading, the culms to 6 dm. tall, usually shorter. Leaf-sheaths glabrous with an adaxial apical collar of hairs, blades lance-linear, to 5-6 cm. long and 4-5 mm. wide, acute, white-margined, glabrous to puberulent, often scabridulous beneath. Panicle to 15 cm. long, axis pubescent, the erect branches usually mostly glabrous, the spikelets often somewhat approximate. Spikelets about 3.5-4 mm. long, acute to subacuminate, long-hirsute. Glumes unequal; first glume 2.5 mm. long, strongly 3-nerved, long-acute; second glume 3-3.5 mm. long, 5-nerved, subacute to subobtuse. Sterile lemma as long as second glume, 5-nerved, acute. Fertile lemma shorter than sterile lemma, smooth, shining, chartaceous. SANTA CRUZ: SARA: Dolores, 450 m., *Steinbach* 1801 (GH); Buenavista, 450-500 m., *Steinbach* 5339 (GH), 6940 bis in part (GH), 7012 (GH).

83. *Ichnanthus* Beauv.

Perennials, erect, decumbent or creeping. Leaves pubescent or glabrous. Inflorescence a panicle. Spikelets pedicellate, disarticulating below the glumes, 2-flowered, the lower floret a sterile lemma or staminate, the upper floret perfect. Glumes 2, the lemma shortly stipitate, the stipe with a pair of membranous appendages basally adnate to the base of the fertile lemma, free above, or the appendages wanting and represented by a pair of small pits or scars.

a. Lemma-appendages present.

b. Lemma-appendages suborbicular, 0.4 mm. long; spikelets 3 mm. long, obtuse. 1. *I. calvescens*.

b. Lemma-appendages narrowly deltoid, 0.6 mm. long; spikelets to 5 mm. long, acute. 2. *I. peruviana*.

a. Lemma-appendages wanting.

c. Leaf-sheath auricles well-developed, to 4 mm. long. 3. *I. breviscrobis*.

c. Leaf-sheath auricles not developed.

d. First glume shorter than second.

- e. Inflorescences terminal and axillary, usually less than 10 cm. long.
- f. Spikelets glabrous, or if with a few hairs, these not papillate-based. 4. *I. pallens*.
- f. Spikelets sparsely pilose, the hairs papillate-based. 5. *I. candidans*.
- e. Inflorescences terminal only, to 20 cm. long. 6. *I. Ruprechtii*.
- d. First glume longer than second. 7. *I. minarum*.

1. ***Ichnanthus calvescens*** (Nees) Doell in Mart. Fl. Bras. 2(2): 285 (1877). Decumbent, the culms to 1 m. tall. Leaf-sheaths pubescent to villous, or glabrous; blades long, lance-elliptic, long-acute, 1-2 cm. wide, densely pubescent above and beneath. Inflorescence to 2 dm. long, narrow, the branches ascending, rachis, branches and pedicels scabridulous, the rachis and branches villous-hispid at the nodes. Spikelets about 3 mm. long, obtuse. First glume about 2.25 mm. long, acute, 3-nerved, the keel scabridulous; second glume about 3 mm. long, 5-nerved. Sterile lemma 3 mm. long. Fertile lemma about 2 mm. long, the appendages suborbicular, 0.4 mm. long. LA PAZ: NOR YUNGAS: Milluguaya, *Buchtien* 737 (Hitchcock); SUR YUNGAS: Chulumani, *Hitchcock* 22653 (Hitchcock).

2. ***I. peruviana*** Mez in Fedde, Rep. Sp. Nov. 15: 129 (1918). Spreading, to 1 m. tall. Leaf-sheaths pubescent to villous; blades lanceolate, to 10 cm long and 1.5 cm. wide, pubescent above and beneath, or scabridulous above. Panicle to 2 dm. long, open, the few branches short, distant, few-flowered, rachis, branches and pedicels scabridulous on the margins. Spikelets to 5 mm. long, acute. First glume to 5 mm. long, acute, puberulent at the apex, 3-nerved, the keel scabridulous; second glume 4 mm. long, obtuse, puberulous at the apex, 5-nerved, the keel scabridulous above. Sterile lemma about 4 mm. long, obtuse, puberulent, somewhat shortly penicillate, at the apex, rather obscurely 5-nerved. Fertile lemma about 2.5-2.75 mm. long, shining, the apex incurved as a short thick beak, the appendages narrowly deltoid, subobtuse, 0.6 mm. long. LA PAZ: NOR YUNGAS: Coroico, 1560 m., *Hitchcock* 22715 (GH).

3. ***I. breviscrobis*** Doell in Mart. Fl. Bras. 2(2): 294 (1877). Erect, stout, to 3-5 m. tall. Leaf-sheaths glabrous, with a pair of well-developed auricles to 4 mm. long at the apex; blades long, lanceolate, to 4 cm. wide, scabridulous above and beneath. Panicle open, to 3 dm. long, the branches ascending, rachis, branches and pedicels puberulent. Spikelets 4 mm. long, obtuse. First glume 2.5 mm. long, obtuse, puberulent, 3-nerved, the nerves scabridulous-ciliate; second glume 4 mm. long, obtuse, puberulent, 7-nerved. Sterile lemma 4 mm. long, puberulent above. Fertile lemma 3 mm. long, the apex incurved as a short, thick, blunt beak, appendages wanting, the pits small. LA PAZ: LARECAJA: San Carlos, Mapiri, 750 m., *Buchtien* 60 (GH).

4. **I. pallens** (Swartz) Munro ex Benth. Fl. Hongk. 414 (1861). Creeping, the culms to 3 dm. long. Leaf-sheaths papillate-pilose, auricles not developed; blades ovate to lanceolate, to 10 cm. long, 1-2 cm. wide, asymmetric, glabrous to papillate-pilose above and beneath. Inflorescences terminal and axillary, to 6 cm. long, the branches ascending-spreading, rachis and branches somewhat pilose, the pedicels scabridulous-puberulent. Spikelets to 4 mm. long, acute, glabrous or often with a few long hairs near the nerves and margin, the hairs not papillate-based. First glume 3 mm. long, long-acuminate, 3-nerved; second glume to 4 mm. long, acute, 5-nerved. Sterile lemma 3 mm. long, acute, 5-nerved. Fertile lemma about 2 mm. long, shining, obscurely keeled, the subacute apex only slightly incurved, appendages wanting. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5322 (GH); SUR YUNGAS: Sirupaya, 1650 m., *Buchtien* (in Baenitz) 1401 (GH). COCHABAMBA: CHAPARE: Antahuacana, Espíritu Santo, 750 m., *Buchtien* 153 (GH). SANTA CRUZ: SARA: bosques del Fraile, 450 m., *Steinbach* 2258 (GH).

5. **I. candicans** (Nees) Doell in Mart. Fl. Bras. 2(2): 291 (1877). Creeping plant, much-branched. Leaf-sheaths papillate-villous, the auricles not developed; blades papillate-villous above and beneath, ovate, to 5 cm. long and 1.5 cm. wide. Inflorescences terminal and axillary, to 7-8 cm. long, branches ascending, rachis, branches and pedicels pubescent to scabridulous-puberulent. Spikelets to 4 mm. long, acute, the glumes sparsely papillate-pilose. First glume about 2.5 mm. long, long-acuminate, 3-nerved; second glume about 4 mm. long, shortly acuminate. Sterile lemma about 3 mm. long, obtuse, 5-nerved. Fertile lemma about 2 mm. long, shining, obscurely 3-nerved, very obtuse, the apex not incurved as a beak, appendages wanting. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 6 (GH).

The line of demarcation between this species and *I. pallens* seems tenuous and rather difficult to draw.

6. **I. Ruprechtii** Doell in Mart. Fl. Bras. 2(2): 293 (1877). Spreading, to 1-2 m. tall. Leaf-sheaths mostly glabrous, auricles not developed; blades lanceolate, to 15 cm. long and 1 cm. wide, glabrous to sparsely pubescent above and beneath. Inflorescences terminal, to 2 dm. long, rachis, branches and pedicels pubescent to pilose, especially at and just below the nodes. Spikelets about 3-4 mm. long. First glume to 3 mm. long, subobtuse, 3-nerved, the keel scabrid-ciliate; second glume 3.5 mm. long, subobtuse. Sterile lemma 3 mm. long, subobtuse. Fertile lemma about 2.5 mm. long, shining, slightly incurved at the subacute apex, appendages wanting. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5336 (GH).

7. **I. minarum** (Nees) Doell in Mart. Fl. Bras. 2(2): 294 (1877). Straggling, sprawling plant. Leaf-sheaths glabrous, auricles not developed; blades lanceolate, to 12 cm. long and 2 cm. wide, glabrous or sparsely pubescent above and beneath, the hairs often papillate-

based. Inflorescence a terminal panicle of a few unbranched racemes, the panicle to 10 cm. long, rachis, branches and pedicels puberulent-scabridulous. Spikelets dense on the raceme-axes, to 4.5 mm. long. First glume 4.5 mm. long, long-acute, scabridulous below, the keel scabridulous, a few long hairs near the apical margins; second glume 3.5 mm. long, similar to the first glume in pilosity. Sterile lemma 3 mm. long, glabrous, 5-nerved, subobtuse. Fertile lemma shining, about 2.5 mm. long, subacute, appendages wanting. LA PAZ: LARECAJA: Cerro del Iminapi, 2650 m., *Mandon* 1256 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22619 (GH).

84. *Lasiacis* (Griseb.) Hitchc.

Perennials, sprawling or clambering, to 10 m., much-branched, woody-stemmed. Leaves flat, rather firm, lanceolate to more or less elliptic, subpetiolate. Inflorescence a rather open panicle; spikelets obliquely placed on the pedicels, 2-flowered, the sterile lemma below the fertile, glumes markedly unequal, lanate at the apex; second glume and sterile lemma similar in appearance; fertile lemma and palea shining, indurate to bony, their apices briefly tufted with short woolly hairs in a slight crateriform depression; disarticulation below the glumes.

Ligule prominent, brown, to 2 mm. long; leaf-blades glabrous above.

..... 1. *L. ligulata*.

Ligule inconspicuous, usually hidden, sometimes to 1 mm. long; leaf-blades pubescent to papillate-hispid above and beneath.

..... 2. *L. sorghoidea*.

1. *Lasiacis ligulata* Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 337 (1917). Plants to 5-10 m. long. Leaf-blades narrowly lanceolate, to 12 cm. long, somewhat pubescent to puberulous beneath. Panicle to 10 cm. long, rachis, branches and pedicels puberulent to scabridulous. Spikelets ovoid to obovoid, to 5 mm. long. First glume to 2.5 mm. long, many-nerved; second glume as long as the spikelet, many-nerved, the central nerve more prominent than the others. Sterile lemma as long as second glume, more shining. Fertile lemma slightly shorter than sterile lemma, longitudinally striatulate but not rugose. Glumes and sterile lemma black at maturity. LA PAZ: SUR YUNGAS: Colaya, 1760 m., *Mexia* 4307 (GH). COCHABAMBA: CHAPARE: Locotal, 1600 m., *Steinbach* 9091 (GH); Incachaca, 2400 m., *Steinbach* 9091 (GH).

2. *L. sorghoidea* (Desv.) Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 338 (1917). Plants to 5-7 m. long. Leaf-blades lanceolate to somewhat elliptic, to 2.5 cm. long; sheaths sparsely to densely pubescent or villous, blades pubescent to papillate-hispid above and beneath. Panicle to 20 cm. long and nearly as broad at maturity, axis pubescent to sparsely hispid, branches and pedicels puberulent to scabridulous. Spikelets obovoid to subglobose, to 3.5-4 mm. long. First glume 1.5-2

mm. long, not conspicuously nerved, the central nerve prominent; second glume as long as the spikelet, many-nerved. Sterile lemma as long as second glume. Fertile lemma slightly shorter than sterile lemma, obtuse, prominently striatulate. LA PAZ: NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 157 (GH); SUR YUNGAS: Guanay, 630 m., *Rusby* 191 (GH). COCHABAMBA: CHAPARE: Antahuacana, Espíritu Santo, 750 m., *Buchtien* (in 1909) 161 (GH); CERCADO: Cochabamba, *Bang* 1289 (GH). SANTA CRUZ: SARA: 400-450 m., *Steinbach* 1931 (GH), 5551 (GH), 7111 (GH).

85. *Sacciolepis* Nash

Sacciolepis myuros (Lam.) Chase in Proc. Biol. Soc. Wash. 21: 7 (1908). Annual, to 1 m. high, in wet or marshy habitats. Leaf-blades flat or folded, long, linear, to 5 mm. wide, usually glabrous, but occasionally sparsely pilose above and beneath. Inflorescence a terminal, racemose, compact, narrow panicle, spicate in appearance, generally 10 cm. or less in length, occasionally to 20 cm., the rachis, branchlets and pedicels more or less densely puberulent. Spikelets about 2 mm. long, pointed, disarticulation below the glumes, 2-flowered, the lower floret a sterile lemma, occasionally a staminate floret, the upper floret perfect. Glumes unequal, the first to 1.5 mm. long, 3-nerved, the second inflated or somewhat saccate, to 2 mm. long, 7-9-nerved, often puberulous near the apex. Sterile lemma as long as the second glume and similar in appearance; fertile lemma shorter than the sterile and concealed by it, hard-textured, shining, sometimes sparsely and minutely puberulent, the margins not inrolled but revealing the hard shining palea, this shorter than but similar to the fertile lemma, the fruit minutely stipitate. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 7030 (GH), 7101 (GH).

86. *Hymenachne* Beauv.

Hymenachne donacifolia (Raddi) Chase in Journ. Wash. Acad. Sci. 13: 177 (1923). Perennial, to 1 m. high, in wet or swampy habitats. Leaf-sheaths coarsely ciliate, the glabrous blades broadly lanceolate, to 20 cm. long and 3 cm. wide, the bases cordate-clasping or even somewhat auriculate. Inflorescence a terminal, racemose panicle to 3 dm. long, somewhat open, the branches mostly ascending, the rachis, branches and pedicels finely and densely puberulent. Spikelets clustered, acuminate, to 3 mm. long, 2-flowered, the lower floret a sterile lemma, the upper floret perfect; disarticulation below the glumes. Glumes very unequal, the first about 1 mm. long, acute, faintly 3-nerved, the keel ciliolate on the upper portion; second glume to 2 mm. long, acuminate, strongly 3-nerved, neither saccate nor inflated. Sterile lemma about 2.5 mm. long, acuminate, similar to the second glume; fertile lemma shorter than the sterile, without apparent

nerves, smooth, rather shiny, minutely puberulent near the apex, not firm and indurate. Palea as long as the fertile lemma, similar in appearance and texture. SANTA CRUZ: SARA: Curichis, monte de Palometillas, 400 m., *Steinbach* 2150 (GH).

87. *Homolepis* Chase

Homolepis aturensis (HBK). Chase in Proc. Biol. Soc. Wash. **24**: 146 (1911). A decumbent to sprawling perennial, culms to 5 dm. high. Leaf-sheaths densely ciliate and sparsely pilose, the narrowly lanceolate blades flat, to 1.5 cm. wide, often sparsely pilose when young and glabrescent with age, the margins scabridulous. Inflorescence a terminal, racemose, rather narrow panicle to 10 cm. long, the rachis, branches and pedicels glabrous. Spikelets to 7 mm. long, somewhat fusiform, 2-flowered, the upper floret perfect, the lower sterile or sometimes staminate, disarticulation below the glumes. Glumes equal or subequal, to 7 mm. long, the first glume 9-nerved, glabrous; second glume slightly shorter, fewer-nerved, the margins appressed-villous. Sterile lemma shorter than the glumes, enclosing the fertile lemma, densely appressed-villous along the margins; fertile lemma shorter than the sterile, glabrous, shining, firm-textured but not indurate, partially enclosing the similar but shorter palea. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1844 (GH), 5120 (GH), 7013 (GH).

88. *Isachne* R. Br.

Isachne arundinacea (Swartz) Griseb. Fl. Brit. W. Ind. 553 (1864). Climbing perennial, the branches up to 6 m. long. Leaf-blades flat, lanceolate, to 20 cm. long and 1.5-2 cm. wide, scabrid above and beneath. Inflorescence a terminal racemose panicle to 12 cm. long, the branches ultimately spreading, the rachis and branches puberulent-scabridulous, the pedicels usually glabrous. Spikelets subglobose, about 2 m. long, disarticulation below the glumes, 2-flowered, the upper floret perfect, the lower floret staminate or perfect. Glumes nearly equal, often suborbicular, about 1.5 mm. long, with a tuft of a few short hairs below the apex. Staminate lemma and palea equal in length, about 2 mm. long, indurate, shining; fertile floret slightly smaller; both lemmas with a few short basal hairs. YUNGAS: *Bang* 297 (GH).

89. *Oplismenus* Beauv.

Oplismenus hirtellus (L.) Beauv. Ess. Agrost. 54, 168 (1812). Spreading, much-branched perennial, the culms 3-5 dm. high. Leaf-sheaths glabrous to densely hirsute, the lanceolate or lance-ovate blades to 10 cm. long, glabrous above, sometimes scabridulous beneath, the margins undulate. Inflorescence a terminal few-branched panicle

of 3-6 short (1-3 cm.) densely flowered racemes, the spikelets paired or solitary, unilateral, very shortly pedicellate, the rachis scabridulous to pubescent or coarsely ciliate. Spikelets 2-flowered, the lower floret a sterile lemma, the upper floret perfect, disarticulation below the glumes. Glumes subequal, about 2.5-3 mm. long, 3-5-nerved, variably pubescent to nearly glabrous, awn of first glume to 6 mm. long, awn of second glume about 2 mm. long. Sterile lemma about 3 mm. long, about 7-nerved, variably pubescent, especially on the nerves, shortly awned or mucronate. Fertile lemma to 2.5 mm. long, indurate, shining, very faintly nerved, the flat margins clasping the palea. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5331 (GH); NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 738 (GH); Coripata, *Bang* 2079 (GH). SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1067 (GH), 1859 (GH), 5681 (GH), 1010 (GH); Dolores, 450 m., *Steinbach* 2036 (GH).

90. *Echinochloa* Beauv.

Echinochloa crus-pavonis (HBK.) Schult. Mant. 2: 269 (1824). Annual, erect to decumbent at base, the culms to 1 m. tall. Leaf-sheaths glabrous; blades linear, to 1.2 cm. wide, glabrous, the margins scabridulous. Inflorescence a terminal panicle of racemes, the spikelets solitary or unilaterally clustered on the racemes, the rachis hispid at the nodes, branches and pedicels scabrid. Spikelets about 3 mm. long, plano-convex, 2-flowered, the lower floret sterile or staminate, the upper floret perfect. First glume about 1.5 mm. long, broadly ovate, acute, few-nerved scabrid to hispidulous; second glume 3 mm. long, awned, few-nerved, the nerves strongly short-hispid. Sterile lemma 3 mm. long, few-nerved, the nerves short-hispid, the awn to 4 mm. long. Fertile lemma indurate, about 2.5 mm. long, with a terminal awn or mucro 0.5 mm. long, shining; palea similar but narrower and slightly shorter. LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1258 (GH); Hacienda Simaco, 1400 m., *Buchtien* 5313 (GH); NOR YUNGAS: Coripata, *Bang* 2108 (GH); Polo-Polo, near Coroico, 1100 m., *Buchtien* 445 (GH).

91. *Setaria* Beauv.

See Rominger, J. M. Taxonomy of *Setaria* (Gramineae) in North America. Illinois Biological Monographs, no. 29. 1962.

Annuals or perennials, erect to decumbent and spreading. Leaf-sheaths and blades glabrous to varyingly pubescent. Inflorescence a condensed panicle, the branches seldom obvious, mostly spicate in appearance. Spikelets mostly plano-convex (very obscurely so in 1 species), subtended by 1 to several antrorsely or retrorsely scabrous bristles, 2-flowered, the lower floret a sterile lemma (or occasionally a staminate floret), the upper floret perfect; disarticulation below the

glumes. Glumes unequal; fertile lemma coriaceous to indurate, smooth in 2 species, or rugose or rugulose.

a. Bristles antrorsely scabrous.

b. Fertile lemma neither rugose nor rugulose.

c. Leaves plicate; spikelet 3-4 mm. long; bristles 1-2 cm. long. 1. *S. Poiretiana*.

c. Leaves not plicate, spikelet 2-2.5 mm. long; bristles 5-6 mm. long. 6. *S. oblongata*.

b. Fertile lemma transversely rugose or rugulose.

d. Nodes pubescent to villous. 9. *S. barbinodis*.

d. Nodes glabrous.

e. Bristles below spikelet 5 or more. 2. *S. geniculata*.

e. Bristles below spikelet 1, or 2-3 by abortion of spikelets.

f. Leaf-base rounded, not petiolate nor subpetiolate. 8. *S. argentina*.

f. Leaf-base gradually tapered, petiolate or subpetiolate.

g. Main panicle about 10 cm. long; bristles to about 1 cm. long. 10. *S. trichorhachis*.

g. Main panicle about 20-30 cm. long; bristles to about 2-3 cm. long. 7. *S. vulpiseta*.

a. Bristles retrorsely scabrous, at least on upper half.

h. Spikelets 2.5-3 mm. long. 3. *S. tenax*.

h. Spikelets 1.5 mm. long.

i. Bristles 2-5 mm. long. 4. *S. scandens*.

i. Bristles 1-1.5 cm. long. 5. *S. tenacissima*.

1. ***Setaria Poiretiana*** (Schult. in Roem. & Schult.) Kunth, Rév. Gram. 1: 47 (1829). Perennial, the culms to 1-2 m. tall, sometimes villous near the nodes, but the nodes glabrous. Leaf-sheaths papillate-hirsute; leaf-blades plicate, to 5 cm. wide, often pubescent or puberulous below, scabridulous above and beneath, the base tapering and at least subpetiolate. Panicle to 6 dm. long, the branches ascending, the rachis, branches and pedicels puberulent. Spikelets acute, 3-4 mm. long, secund on the branches, slightly plano-convex, subtended by 1 bristle 1-2 cm. long. First glume 1.5 mm. long, obtuse, 3-nerved; second glume about 2 mm. long, obtuse, 5-nerved. Sterile lemma as long as the spikelet, acute, 2-nerved. Fertile lemma slightly shorter than the sterile, acute to somewhat acuminate, not rugose but prominently longitudinally striatulate. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 18 (GH); NOR YUNGAS: Coroico, 1560 m., *Hitchcock* 22719 (GH). COCHABAMBA: CHAPARE: Locotal, 1500 m., *Steinbach* 9019 (GH). SANTA CRUZ: SARA: Cerro del Amboró, 1000 m., *Steinbach* 2998 (GH).

2. ***S. geniculata*** (Lam.) Beauv. Ess. Agrost. 51, 178 (1812). *S. gracilis*, *S. gracilis* f. *brevispica* and *S. gracilis* f. *penicillata* of the Catalogue. Perennial, to 12 dm. tall, the culms geniculate, nodes glabrous. Leaf-sheaths glabrous; blades glabrous beneath, scabridu-

lous above, to 8 mm. wide. Panicle to 10 cm. long but usually shorter, the branches extremely short, rachis, branches and pedicels densely short-pubescent or hispid. Spikelets 2-2.5 mm. long, strongly plano-convex when mature, subtended by 5 or more bristles, these to 1 cm. long on early-season plants or 2-3 mm. long on late-season plants. First glume about 1 mm. long, obtuse, 3-nerved; second glume about 1.5 mm. long, abruptly acute at apex, about 5-nerved. Sterile lemma as long as the spikelet, about 7-nerved, subacute, enclosing a well-developed palea and often a staminate floret. Fertile lemma as long as the sterile, markedly transversely rugose, the palea-apex free at maturity. YUNGAS: *Bang* 218 (GH), 273 (GH). LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1259 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22634 (GH); Sirupaya, 2200 m., *Buchtien* 7029 (GH). COCHAMBAMBA: CERCADO: Cochabamba, 3300 m., *Shepard* 259 (GH), 2500 m., *Eyerdam* 24666 (GH); Mollemolle, 2800 m., *Steinbach* 4057 (GH). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 6199 (GH).

3. *S. tenax* (L. Rich.) Desv. Opusc. 78 (1831). Perennial, to 1-2 m. tall, the nodes glabrous. Leaf-sheaths glabrous to puberulent, the margins papillate-ciliate; blades to 2 cm. wide, abruptly rounded at the base but not petiolate, scabridulous to pubescent. Panicle to 3 dm. long, the rachis short-villous, the short branches and pedicels puberulous to scabridulous. Spikelets 2.5-3 mm. long, plano-convex to suborbicular, each subtended by a single bristle 1-2 cm. long, this antrorsely scabrous at the base and retrorsely scabrid above. First glume about 1 mm. long, broadly ovate, subacute, 5-nerved; second glume 1.5-2 mm. long, subobtuse, about 7-nerved. Sterile lemma as long as the spikelet, usually with a well-developed palea. Fertile lemma as long as the sterile, smoothish at the apex, strongly transversely rugose below. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22685 (GH).

4. *S. scandens* Schrad. ex Schult. in Roem. & Schult. Syst. Veg. Mant. 2: 279 (1824). Annual, to 8 dm. tall, the culms geniculate at the base, the nodes glabrous. Leaf-sheaths glabrous, the margins ciliate; blades to 1 cm. wide, abruptly narrowed at the base, scabrous-pubescent above and beneath. Panicle to 10 cm. long, the branches very short, rachis short-pubescent with scattered, long, hispid hairs, branches and pedicels puberulous-scabridulous. Spikelets about 1.5 mm. long, plano-convex, subtended by 1-3 bristles retrorsely barbed on the upper portion, the bristles 2-5 mm. long. First glume about 0.75 mm. long, broadly ovate, subacute, 3-nerved; second glume nearly 1.5 mm. long, 5-nerved, subobtuse. Sterile lemma 5-nerved, as long as the spikelet with a palea half as long. Fertile lemma transversely rugose or rugulose, as long as the sterile lemma. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5330 (GH); NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* 449 (GH).

5. *S. tenacissima* Schrad. ex Schult. in Roem. & Schult. Syst. Veg.

Mant. 2: 279 (1824). Annual, to 2 m. tall, nodes glabrous. Leaf-sheaths glabrous below, scabrous above; blades to 1 cm. wide, pubescent and scabrous above and beneath. Panicle to 2 dm. long, the branches short (less than 1 cm.), rachis pubescent to hispid, branches and pedicels pubescent. Spikelets plano-convex, 1.5 mm. long, each subtended by a retrorsely scabrous bristle 1-1.5 cm. long. First glume about 1 mm. long, 3-nerved, subobtuse; second glume nearly 1.5 mm. long, 5-nerved. Sterile lemma 1.5 mm. long, 3-5-nerved. Fertile lemma as long as the sterile or slightly shorter, rugulose on the lower portion. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5329 (GH); NOR YUNGAS: Coroico, 1560 m., *Hitchcock* 22717 (GH).

6. *S. oblongata* (Griseb). Parodi in *Physis*, 9: 38 (1928). Perennial, to 1.5 m. tall, nodes glabrous. Leaf-sheaths glabrous below, scabrid above; blades long, to 1 cm. wide, scabrous above and beneath. Panicle to 1 dm. long, the branches very short, rather lax, rachis short-villous, branchlets and pedicels puberulent. Spikelets 2-2.5 mm. long, plano-convex, each subtended by a single antrorsely scabrous bristle 5-6 mm. long. First glume 1.5 mm. long, subobtuse, 5-nerved; second glume about 2 mm. long, 7-nerved. Sterile lemma as long as the spikelet, 5-nerved. Fertile lemma as long as the sterile, smooth, shining. LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1260 (Hitchcock).

7. *S. vulpiseta* (Lam.) Roem. & Schult. *Syst. Veg.* 2: 495 (1817). Perennial, culms to 2 m. tall, nodes glabrous. Leaf-sheaths somewhat carinate, glabrous below, scabrous to pubescent above; blades basally petiolate or subpetiolate, to 3 cm. wide, scabrous above and beneath. Panicle to 3 dm. long, the ascending branches to 3-4 (occasionally nearly 5) cm. long, rachis and branches villous, pedicels puberulent. Spikelets to 2.5 mm. long, plano-convex, each subtended by 1-2 antrorsely scabrous bristles 2-3 cm. long. First glume about 1 mm. long, 3-5-nerved; second glume about 2 mm. long, 7-nerved. Sterile lemma as long as the spikelet, 5-nerved, with a well-developed palea. Fertile lemma 2.5 mm. long, smooth near the apex, markedly rugose below. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1178 (GH); Río Surutú, 400 m., *Steinbach* 6842 (GH).

8. *S. argentina* Herrm. in *Beitr. Biol. Pflanz.* 10: 54 (1910). Perennial, to 10 dm. tall, the nodes glabrous. Leaf-sheaths glabrous below, sparsely papillate-hirsute above, long-ciliate; blades abruptly rounded at base, to 1 cm. wide, papillate-pubescent above and beneath. Panicle to 12 cm. long, the branches very short, the rachis, branches and pedicels puberulent. Spikelets plano-convex, to 2.5 mm. long, each subtended by 1 antrorsely scabrous bristle (occasionally 2) 8-10 mm. long. First glume nearly 1.5 mm. long, subacute, 3-nerved; second glume about 2 mm. long, acute, 5-nerved. Sterile lemma 2.5 mm. long, acute. Fertile lemma nearly as long as the sterile, smooth above, rugulose below. LA PAZ: MURILLO: Cotaña, 2450 m., *Buchtien* 286 (GH); LARECAJA: vic. Sorata, *Mandon* 1262 (GH). COCHABAMBA:

CERCADO: near Cochabamba, *Hitchcock* 22803 (GH); Valle de Cochabamba, 2700 m., *Steinbach* 9714 (GH).

9. *S. barbinodis* Herrm. in Beitr. Biol. Pflanz. 10: 60 (1910). Perennial, to 10 dm. high, the nodes pubescent to villous. Leaf-blades linear, long, to 7 mm. wide, scabrid above and beneath, with occasional hairs but hardly pubescent. Panicle to 15 cm. long, interrupted below, the branches short, rachis short-pubescent with few to many long hairs intermixed, the branches and pedicels short-pubescent. Spikelets subglobose, to 3 mm. long, each subtended by 1 antrorsely scabrous bristle to 1 cm. long. First glume about 2 mm. long, acute, 3-nerved; second glume 2.5 mm. long, broad, shortly apiculate, 5-7-nerved. Sterile lemma 3 mm. long, shortly apiculate, 5-nerved. Fertile lemma slightly shorter than the sterile lemma, rugulose to rugose. LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1261 (US; type-number).

10. *S. trichorhachis* (Hack.) R. C. Foster, comb. nov. *S. Liebmannii* f. *trichorhachis* Hack. in Fedde, Rep. Nov. Spec. 8: 46 (1910). Perennial, to 8 dm. tall, the nodes glabrous. Leaf-sheaths glabrous below, sparsely pubescent above, ciliate; blades gradually tapered and subpetiolate at base, to 1.5 cm. wide, scabrous above and beneath. Panicle to 8 cm. long, the branches very short, rachis short-pubescent with numerous longer hairs intermixed, branches and pedicels puberulent. Spikelets plano-convex, 3 mm. long, each subtended by 1 antrorsely scabrous bristle about 1 cm. long. First glume about 1 mm. long, subacute, 5-nerved; second glume 2 mm. long, obtuse, 7-nerved. Sterile lemma about 2.5 mm. long, 5-nerved, acute. Fertile lemma 2.5 mm. long, rugose below, rugulose to smooth above. Without locality: *Bang* 2160 (GH).

92. *Pennisetum* L. Rich.

Perennials, to 5 m. tall. Leaf-blades flat, sparsely pubescent to glabrous and scabridulous, petiolate to subpetiolate. Inflorescence more or less spicate in appearance, the spikelets solitary to few in a fascicle, sessile or subsessile, subtended by a ring of equal to unequal, basally plumose or antrorsely puberulent bristles, 2-flowered, the lower floret a sterile lemma or sometimes a staminate floret, the upper floret perfect; disarticulation below the glumes. Glumes unequal. Fertile lemma chartaceous to herbaceous, mostly smooth.

- a. Culm-nodes villous. 4. *P. latifolium*.
- a. Nodes glabrous.
 - b. Bristles plumose.
 - c. Longest bristles 1.5 cm. long; spikelets 7 mm. long. 1. *P. setosum*.
 - c. Longest bristles 4 cm. long; spikelets to 1.2 cm. long. 2. *P. villosum*.
 - b. Bristles not plumose.

- d. Longest bristles about as long as the spikelet (4-5 mm.)
..... 5. *P. mutilatum*.
- d. Longest bristles much longer than the spikelet (about 1.2 cm. long).
- e. Second glume 2-3 mm. long; spikelet to 7 mm. long.
..... 6. *P. chilense*.
- e. Second glume less than 1 mm. long; spikelet to 5 mm. long.
..... 3. *P. tristachyum*.

1. ***Pennisetum setosum*** (Swartz) L. Rich. in Pers. Synops. Pl. 1: 72 (1805). Culms 1-2 m. tall, nodes glabrous. Leaf-sheaths glabrous; blades to 4 dm. long and 1.8 cm. wide, pubescent or scabridulous above and beneath. Inflorescence to 25 cm. long, purplish. Spikelets about 4 mm. long. Bristles in 2 series; outer series shorter to slightly longer than the spikelet, antrorsely puberulent; inner series about twice the length of the spikelet (1 bristle much longer than the rest, to 1.5 cm. long), densely silky-plumose basally. First glume about 0.5 mm. long, sometimes absent; second glume 3.5 mm. long, longer than the sterile lemma, acute, puberulous on the upper portion. Sterile lemma about 3 mm. long, obtuse, puberulous, the apex finely ciliolate. Fertile lemma about 2.5 mm. long, the apex penicillate. LA PAZ: NOR YUNGAS: Coripata, *Bang* 2168 (GH).

2. ***P. villosum*** R. Br. in Fresen. in Mus. Sencken. 2: 134 (1837). Culms to 0.5 m. tall, nodes glabrous. Leaf-sheaths glabrous; blades 3-5 mm. wide, scabridulous beneath, occasionally sparsely pilose above. Inflorescence to 8 cm. long, sometimes pale-tawny. Spikelets to 1.2 cm. long, 1-4 in a shortly pedunculate fascicle, the peduncle densely short-villous at the base. Bristles to 4 (-5) cm. long, the outer shorter and sparsely or not at all plumose, the inner long and plumose. First glume about 0.5 mm. long; second glume about 3.5 mm. long, long-acute. Sterile lemma about 1 cm. long, long-acute, scabridulous on the nerves above the middle. Fertile lemma 1 mm. shorter than the sterile, acuminate. CHUQUISACA: OROPEZA: outskirts of Sucre, 2700 m., *Cárdenas* 4116 (GH).

3. ***P. chilense*** (Desv.) Jacks. ex R. E. Fries in Nov. Act. Soc. Sci. Upsal. (ser. 4) 1: 172 (1905). Culms 1-2 m. tall, from a distinct rhizome, the nodes glabrous. Leaf-sheaths glabrous; blades scabrous beneath, sometimes scabridulous above, to 1 cm. wide. Inflorescence to 2 dm. long, grayish to purplish. Spikelets to 7 mm. long. Bristles of varying lengths, from the length of the spikelet to 1.5 cm. long, antrorsely puberulent, none plumose. First glume nearly 1 mm. long, obtuse; second glume about 2-3 mm. long, subacute, sometimes ciliolate. Sterile lemma 6 mm. long, scabridulous on the upper portion, long-acute. Fertile lemma 6 mm. long, long-acute. LA PAZ: MURILLO: La Paz, 3700 m., *Buchtien* 81 (GH), 161 (GH), *Bang* 55 (GH), *Mandon* 1265 (GH); Palca, 3700 m., *Hitchcock* 22583 (GH). COCHABAMBA: CHAPARE: Sacaba, 2900 m., *Steinbach* 8809 (GH). POTOSÍ: SUR

CHICHAS: Oploca, *Hitchcock* 22898 (GH). TARIJA: CERCADO: Concepción, 1900 m., *Fiebrig* 2595 (GH).

4. *P. latifolium* Spreng. Syst. Veg. 1: 302 (1825). Culms to 1-3.5 dm. tall, the nodes villous. Leaf-sheaths glabrous to pilose on the upper portion, or papillate-hirsute, the margins hispid-ciliate; blades to 35 cm. long and 5 cm. wide, usually narrower, scabridulous above and beneath. Inflorescence to 10 cm. long, greenish. Spikelets about 4.5 mm. long, acute. Bristles few, not plumose, shorter than or as long as the spikelet, 1 bristle to 1 cm. long. First glume 0.5 mm. long, subacute; second glume about 1 mm. long, ovate, subacute, ciliolate at the apex. Sterile glume as long as the spikelet, acute, scabrid-puberulous. Fertile lemma slightly shorter than the sterile lemma, subacuminate, slightly scabridulous at the apex. LA PAZ: LARECAJA: vic. Sorata; Lucmapampa, Iminapi, 2600 m., *Mandon* 1263 (GH). COCHABAMBA: CERCADO: west of Cochabamba, *Hitchcock* 22847 (GH); CHAPARE: Locotal, 1500 m., *Steinbach* 9014 (GH).

5. *P. mutilatum* (O. Ktze.) Hack. ex Index Kew. Suppl. 2: 137 (1904). *P. sagittatum* Henr. in Blumea, Suppl. 1: 229 (1937). Culms 1-2 m. tall, nodes glabrous. Leaf-sheaths sparsely papillate-hirsute to glabrous; blades glabrous or puberulent at base when young, to 1.5 cm. wide. Inflorescence to 10 cm. long. Spikelets about 4 mm. long. Bristles few, short, equaling or slightly exceeding the spikelet, not plumose. First glume between 0.5-1 mm. long, obtuse; second glume 2-3 mm. long, acute, puberulous above. Sterile lemma nearly as long as the spikelet, acute, antrorsely puberulent on entire dorsal surface. Fertile lemma to 4 mm. long, occasionally scabridulous near the acute apex. LA PAZ: LARECAJA: vic. Sorata; between Munaypata and Challasuyo, 2650 m., *Mandon* 1264 (GH).

6. *P. tristachyum* (HBK.) Spreng. Syst. Veg. 1: 302 (1825). *P. tristachyum* subsp. *boliviense* Chase in Contrib. U. S. Nat. Herb. 24: 486 (1927). Culms 2-6 m. tall, branched, nodes glabrous. Leaf-sheaths glabrous; blades to 4 dm. long and 3 or more cm. wide, petiolate, the petioles villous and the blades sparsely villous above and beneath at the base. Inflorescence to 10 cm. long. Spikelets about 5 mm. long, acute. Bristles unequal in length, the longest to 1.5 cm. long, not plumose. First glume about 0.25 mm. long; second glume less than 1 mm. long. Sterile lemma as long as the spikelet, acuminate, scabridulous toward the apex. Fertile lemma slightly shorter than the sterile lemma, acuminate, glabrous or nearly so. LA PAZ: NOR YUNGAS: Coroico, 1100 m., *Buchtien* 451 (GH); Colapampa, *Bang* 2340 (GH). SANTA CRUZ: SARA: Cerro Hosana, 1300 m., *Steinbach* 3379 (GH); Cerro La Negra, 1800 m., *Steinbach* 8172 (GH).

93. *Cenchrus* L.

Annual or perennial, often to 1 m. tall. Inflorescence a terminal raceme. Spikelets 1-4 in a group, surrounded by an involucre (modi-

fied sterile branchlets) forming spiny burs, the spines usually retrorsely barbed; disarticulation below the burs. Spikelets 2-flowered, the lower floret a sterile lemma, the upper floret perfect. Glumes unequal, the first glume sometimes obsolete.

- a. Burs with 1 spikelet; involucral lobes united at the base only. 1. *C. myosuroides*.
- a. Burs with more than 1 spikelet; involucral lobes united to about the middle.
 - b. Burs with a basal ring of bristles. 4. *C. pauciflorus*.
 - c. Involucral lobes interlocking; burs about 4 mm. wide. 2. *C. viridis*.
 - c. Involucral lobes not, or seldom, interlocking; burs 5-7 mm. wide. 3. *C. echinatus*.
 - b. Burs without a basal ring of bristles. 4. *C. pauciflorus*.

1. ***Cenchrus myosuroides*** HBK. Nov. Gen. & Sp. 1: 115 (1816). Perennial, rather woody, to 1.5 m. tall, glaucous, glabrous. Leaf-blades 5-12 mm. wide. Raceme to 25 cm. long, dense; burs 1-flowered, to 5 mm. wide, the lobes united at the base only, free above, the base hispidulous, the outer bristles of the involucre shorter than the inner, both series erect, the inner about equaling the spikelet. Spikelet about 5 mm. long, acute. First glume about 2 mm. long, broadly ovate, acute, 1-nerved; second glume 3.5-4 mm. long, 5-nerved, the midrib prominent. Sterile lemma 4.5 mm. long, similar to second glume. Fertile lemma 5 mm. long, acute; palea almost as long, narrower. COCHABAMBA: TARATA: Anzaldo, 3000 m., *Cárdenas* 2425 (GH); CERCADO: Cochabamba, *Hitchcock* 22806 (GH); Cochabamba Railway Station, 2560 m., *Cárdenas* 2391 (GH); Taquiña, 2700 m., *Steinbach* 9801 (GH).

2. *C. viridis* Spreng. Syst. Veg. 1: 301 (1825). Annual, up to 1 m. tall, glabrous. Leaf-blades to 12 mm. wide. Raceme to 10 cm. long, rather dense; burs usually 3-flowered, subglobose, 4 mm. wide (excluding the bristles), lobes interlocked at maturity, the base pubescent. Spikelet about 7 mm. long, acute. First glume narrowly ovate, 3 mm. long, 1-nerved; second glume 5 mm. long, acute, 5-nerved. Sterile lemma to 6 mm. long, acute, several-nerved. Fertile lemma slightly longer. LA PAZ: SUR YUNGAS: Guanay, *Rusby* (M. E.) 190 (*Hitchcock*).

3. *C. echinatus* L. Sp. Pl. 1050 (1753). Annual, to 6 dm. high. Leaf-blades to 8 mm. wide, sparsely pilose above near the base. Raceme to 10 cm. long; burs usually 4-flowered, lobes united to the middle, seldom interlocking at maturity, the tips spinose, 5-7 mm. wide (excluding the bristles), pubescent. Spikelet about 7 mm. long. First glume ovate, 2 mm. long, 1-nerved, acute; second glume 4 mm. long, 5-nerved. Sterile lemma 5 mm. long. Fertile lemma 5 mm. long, long-acute. LA PAZ: NOR YUNGAS: Milluguaya, 1300 m., *Buchtien*

4171 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6980 bis (GH): Río Surutu, 400 m., *Steinbach* 5576 (GH), 6838 (GH).

4. *C. pauciflorus* Benth. Bot. Voy. Sulphur, 56 (1840). Annual, often in mats, to 9 dm. tall. Leaf-blades to 7 mm. wide. Raceme to 8 cm. long; burs usually 2-flowered, 4-6 mm. wide, pubescent, the lobes united to the middle. Spikelet about 6 mm. long. First glume about 2 mm. long, acute, 1-nerved; second glume 4 mm. long, 3-nerved. Sterile and fertile lemmas as long as the spikelet, several-nerved. LA PAZ: LARECAJA: vic. Sorata; San Pedro, 2650 m., *Mandon* 1267 (GH).

94. *Olyra* L.

Perennials, often very tall, often rather woody, plants monoecious. Leaf-blades variable in size, often very large, mostly glabrous, petiolate or subpetiolate. Inflorescence a compact to lax panicle; pistillate spikelets at ends of branches, the staminate spikelets below, these pedicellate, smaller, or the upper branches all with pistillate spikelets and the lower branches all staminate. Pistillate spikelets: rather large, 2-flowered, the lower floret a sterile lemma, the first glume absent, the fruit indurate or bony; disarticulation below the glumes. Staminate spikelets: both glumes and the sterile lemma absent, the fertile lemma and palea membranaceous.

a. Leaf-blades oblong- or triangular-deltoid.

b. Panicle short, 2-3 cm. long; glume 2-3 mm. long, not caudate; fruit glabrous. 1. *O. lateralis*.

b. Panicle to 10 cm. long; glume to 2 cm. long, caudate; fruit pubescent. 5. *O. ciliatifolia*.

a. Leaf-blades not deltoid.

c. Fruit pitted.

d. Glume to 1 cm. long, densely pubescent externally. 6. *O. micrantha*.

d. Glume to 3 cm. long; externally glabrous. 3. *O. heliconia*.

c. Fruit not pitted.

e. Glume 2-4 cm. long, caudate.

f. Glume about 2 cm. long. 7. *O. latifolia*.

f. Glume about 4 cm. long. 4. *O. Buchtienii*.

e. Glume 1 cm. long, not caudate. 2. *O. ecaudata*.

1. *Olyra lateralis* (Presl) Chase in Proc. Biol. Soc. Wash. 21: 179 (1908). Straggling. Leaf-blades oblong-deltoid, to 4 cm. long and 1.2 cm. wide, the base truncate to subcordate, glaucous beneath, puberulent above when young. Panicle 2-3 cm. long, few-branched, the branches usually whorled. Pistillate spikelet: ovoid, 2-3 mm. long, glabrous; glume with 3 prominent nerves, sterile lemma similar; fruit shining, not pitted, glabrous. Staminate spikelet: linear, acute, 2.5-3 mm. long, puberulent at base. LA PAZ: LARECAJA: San Carlos, Mapiri, 850 m., *Buchtien* 25 (GH); Hacienda Simaco, 1400 m., *Buchtien* 5333 (GH).

2. *O. ecaudata* Doell in Mart. Fl. Bras. 2(2): 326 (1877). Erect. Leaf-blades oblong, to 20 cm. long and 2.5 cm. wide, scabrid above. Pistillate spikelet: 6-8 mm. long, oblong, acuminate, not caudate. Staminate spikelet: subulate, the lemma cuspidate. PANDO: COBIJA: *Ule* 9146 (Hitchcock).
3. *O. heliconia* Lindm. in Sv. Vet. Akad. Handl. 34(6): 11 (1900). Stout, little-branched, to 2 m. tall. Leaf-blades oblong, to 35 cm. long and 8 cm. wide, the subtruncate base asymmetric, sparsely puberulent when young. Panicle to 30 cm. long, the few branches in 2-3 distant whorls. Pistillate spikelet: glume to 3 cm. long, long-caudate, sterile lemma to 2 cm. long, long-acute to subcaudate, both puberulent within and glabrous externally; fruit to 1 cm. long, glabrous but conspicuously and regularly pitted. Staminate spikelet: about 1 cm. long, narrowly subulate, often purple. LA PAZ: NOR YUNGAS: Coroico, 1560 m., *Hitchcock* 22720 (GH); Polo-Polo, 1100 m., *Buchtien* 450 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 2010 (GH).
4. *O. Buchtienii* Hack. in Fedde, Rep. Sp. Nov. 11: 20 (1912). To 1.5 m. tall. Leaf-blades oblong-lanceolate, to 30 cm. long and 7 cm. wide, the base subtruncate, somewhat asymmetric. Panicle to 15 cm. long, few-branched. Pistillate spikelet: glume and sterile lemma long-caudate, glume to 4 cm. long; glume and lemma puberulent within, scabridulous-puberulent externally; fruit 1 cm. long, glabrous. Staminate spikelet: narrowly ellipsoid, to 4 mm. long, sparsely puberulent. LA PAZ: LARECAJA: San Carlos, Mapiri, 800 m., *Buchtien* 40 (GH).
5. *O. ciliatifolia* Raddi, Agrost. Bras. 19 (1823). Seldom 1 m. tall. Leaf-blades triangular-deltoid, to 10 cm. long and 4 cm. wide, the truncate base asymmetric, glabrous, or pubescent at base when young. Panicle to 10 cm. long, at least the lower branches in whorls. Pistillate spikelet: glume 2 cm. long, very slender-caudate, the sterile lemma similar but shorter, glume and lemma glabrous internally and externally; fruit to 7 mm. long, pubescent. Staminate spikelet: to 7 mm. long, very slender, glabrous. BENI: YACUMA: Lago Rogagua, *Rusby* (M. E.) 1669 (US).
6. *O. micrantha* HBK. Nov. Gen. & Sp. 1: 199 (1816). Very large, to 5 m. tall. Leaf-blades oblong-lanceolate, to 30 cm. long and 10 cm. wide, the base rounded but not cordate, glabrous. Panicle to 30 cm. long. Pistillate spikelet: glume to 1 cm. long, long-caudate, densely pubescent; sterile lemma similar but much shorter; glume and lemma minutely puberulent internally; fruit 3 mm. long, glabrous but regularly and deeply pitted. Staminate spikelet: very narrow, 7 mm. long, the lemma somewhat caudate, glabrous. SANTA CRUZ: ICHILO: Río Vibora, 350 m., *Steinbach* 7572 (GH). LA PAZ: LARECAJA: San Carlos, Mapiri, 750 m., *Buchtien* 76 (GH).
7. *O. latifolia* L. Syst. Nat. (ed. 10) 2: 1261 (1759). To 5 m. tall.

Leaf-blades lanceolate-oblong, to 30 cm. long and 8 cm. wide, glabrous, acuminate, the base asymmetric. Panicle to 15 cm. long. Pistillate spikelet: glume to 2 cm. long, long-caudate, minutely puberulent externally, hispid-ciliate near the base, internally densely puberulent above the middle; sterile lemma similar but shorter; fruit 5 mm. long, shining, apparently somewhat rugose above the middle, glabrous. Staminate spikelet: slender, to 7 mm. long, the lemma short-caudate. LA PAZ: LARECAJA: Mapiri, *Buchtien* 1155 (Hitchcock).

95. *Imperata* Cyrillo

Caespitose, rhizomatous perennials, the rhizome scaly, the culms unbranched, to 1-2 m. tall. Leaf-sheaths often ciliate, otherwise glabrous; leaf-blades flat or involute, glabrous beneath, pubescent to hirsute above (especially near the base) when young. Inflorescence a panicle of racemes. Spikelets 2-flowered, the lower floret a sterile lemma, the upper floret perfect, pedicellate, awnless; disarticulation below the glumes. Glumes mostly subequal, membranaceous to hyaline, more or less densely villous, the hairs much exceeding the spikelet. Sterile lemma and fertile lemma and palea hyaline, thin.

a. Leaf-blades flat.

b. Spikelet 4 mm. long. 1. *I. brasiliensis*.

b. Spikelet 2 mm. long. 3. *I. minutiflora*.

a. Leaf-blades involute (the uppermost sometimes flat). 2. *I. tenuis*.

1. *Imperata brasiliensis* Trin. in Mém. Acad. St. Pétersb. (ser. 6) Math. Phys. Nat. 2: 331 (1832). To 1 m. tall. Leaf-blades flat, to 1.8 cm. wide, mostly glabrous, the margins scabrid. Panicle about 10 cm. long. Spikelets 4 mm. long, glumes acute, the first glume somewhat shorter than the second. BENI: YACUMA: Reyes, *White* (M. E.) 1535 (Hitchcock).

2. *I. tenuis* Hack. in DC. Monogr. Phan. 6: 689 (1889). Plants 0.8-2 m. tall. Leaves mostly involute, the uppermost occasionally flat. Panicle to 2 dm. long. Spikelets 4 mm. long, glumes long-acute, the first glume shorter than the second. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1824 (GH), 6928 (GH); Río Dolores, 450 m., *Steinbach* 1933 (GH).

3. *I. minutiflora* Hack. in DC. Monogr. Phan. 6: 100 (1889). Plant 0.4-1 m. tall. Leaf-blades to 4 mm. wide. Panicle to 2-3 dm. long. Spikelets 2 mm. long, glumes acute, hairs mostly basal. SANTA CRUZ: SARA: Curichi, 400 m., *Steinbach* 2410 (GH); Río Guendá, 400 m., *Steinbach* 6894 (GH).

96. *Saccharum* L.

Saccharum officinarum L. Sp. Pl. 54 (1753). Very large perennial, to 5 m. tall, the culms 2-3 cm. thick. Leaf-sheaths closely imbricate,

the lowermost falling from the culms; blades to 6 cm. wide, midrib very prominent. Inflorescence a plumose panicle to 6 dm. long, the racemes drooping, the rachis disarticulating. Spikelets about 3-4 mm. long, awnless, paired, both with a perfect floret, one sessile, a ring of long hairs at base of each spikelet, 2-flowered. Glumes subequal, acute, subindurate. COCHABAMBA: CHAPARE: Espíritu Santo, *Buch-tien* 2514 (Hitchcock).

97. *Eriochrysis* Beauv.

Erect perennials to 1-2 m. tall. Leaf-blades flat to involute, glabrous to sparsely or densely pubescent. Inflorescence a terminal continuous or interrupted panicle of racemes, the raceme-rachis ultimately disarticulating below the spikelets. Spikelets paired, perfect spikelets sessile, pistillate spikelets pedicellate, both long-villous at the base. Glumes subequal, rather indurate; lemma somewhat hyaline; palea hyaline.

Leaf-blades flat, densely velvety-pubescent; panicle dense, almost uninterrupted, deep golden-brown. 1. *E. cayennensis*.
 Leaf-blades usually involute, glabrous or sparsely pubescent; panicle obviously interrupted, pale to medium-brown.
 2. *E. Warmingiana*.

1. *Eriochrysis cayennensis* Beauv. Ess. Agrost. 8 (1812). Unbranched plant, 1-2 m. tall. Panicle to 12 cm. long, the individual racemes very short. Spikelets about 3 mm. long. First glume obtuse, long-villous on upper portion and along margins; second glume subacute, convex, sparsely long-villous on upper keel. SANTA CRUZ: SARA: Portachuelo, *Steinbach* 1974 (GH); Buenavista, 450-500 m., *Steinbach* 5174 (GH), 6915 (GH).

Occasionally, an intermediate with a more interrupted inflorescence, but almost the typical coloring, will be found, such as *Steinbach* 6975 bis (GH), from Buenavista.

2. *E. Warmingiana* (Hack.) Kuhl. in Comm. Linhas Telegr. Estrat. Matto Grosso, 67: 29 (1922). Caespitose, about 1 m. tall, the nodes pubescent. Panicle about 15 cm. long, the racemes 2-4 cm. long. Spikelets to 5 mm. long. First glume long-acute, the upper portion short-puberulent, with a few long hairs, otherwise glabrous; second glume convex, puberulent, with a few long lax hairs on the upper margin. SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 1916 (GH), 7032 (GH).

98. *Erianthus* Beauv.

Perennials, 1-3 m. tall, the nodes pubescent to long-villous. Leaf-sheaths sparsely to densely pubescent; leaf-blades flat, pubescent or scabrous. Inflorescence a terminal, rather dense, panicle of racemes. Spikelets perfect, paired, 1 sessile, 1 pedicellate, the pedicel villous

in part, the raceme-rachis disarticulating below the spikelets. Glumes equal or subequal, silky-villous, at least at the base, sterile lemma hyaline, fertile lemma hyaline and long-awned; palea small and hyaline.

Leaf-blades to 1.5 cm. wide; panicle light-colored, 3-4 dm. long. 1. *E. Trinii*.

Leaf-blades less than 1 cm. wide; panicle usually purplish, 1.5-2.5 dm. long. 2. *E. angustifolius*.

1. **Erianthus Trinii** (Hack.) in DC. Monogr. Phan. 6: 135 (1889). Plants 2-3 m. tall, leaf-blades to 1.5 cm. wide. Panicle to 3-4 dm. long, the base usually enclosed in the inflated upper leaf-sheath, the culms pubescent below the panicle. Spikelets to 7 mm. long (excluding the awn). Glumes acute to slightly bidentate, the upper portion soft-pubescent. Awn of fertile lemma about 1 cm. long, not geniculate. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22682 (*Hitchcock*).

2. **E. angustifolius** Nees, Agrost. Bras. 316 (1829). Plants about 1 m. tall, leaf-blades 4-8 mm. wide. Panicle 1.5-2.5 dm. long, the base mostly free from the leaf-sheath, culm densely pubescent below panicle. Spikelets to 8 mm. long (excluding the awn). Glumes bidentate, short-pubescent on upper portion. Awn of fertile lemma about 1 cm. long, not geniculate. LA PAZ: NOR YUNGAS: San José, 1500 m., *Hitchcock* 22737 (GH).

99. *Andropogon* L.

Perennials, to 1-2 m. tall. Inflorescence a panicle of racemes, solitary or 2 or more at apices of branches, the common peduncle usually enclosed by a sheathing spathe. Spikelets 2-flowered, with the lower floret a sterile hyaline lemma, paired on a jointed rachis, 1 spikelet sessile and perfect, the other pedicellate, staminate or neuter, or greatly reduced; disarticulation below the glumes. Glumes of perfect spikelet subequal or somewhat unequal, coriaceous, the first glume bicarinate, the margins inflexed. Fertile lemma hyaline, awned or awnless. Pedicellate spikelet sometimes with the first glumes aristate, sometimes reduced to a pedicel, the pedicels often conspicuously villous.

a. Spikelets awnless.

b. Rachis-joints clavate, with a cupular hollow at the summit. 2. *A. virgatus*.

b. Rachis-joints not clavate, the summit without a cupular hollow.

c. First glume of sessile spikelet glabrous.

d. Culms 1-2 m. tall; leaf-blades long-attenuate, not boat-shaped at the tip. 9. *A. bicornis*.

d. Culms 1 m. tall or less; leaf-blades not long-attenuate, boat-shaped at the tip. 11. *A. Selloanus*.

c. First glume of sessile spikelet not glabrous.

e. Glume pilose on and near keels. 6. *A. Hassleri*.

e. Glume merely ciliolate on keels. 10. *A. leucostachyus*.

- a. Spikelets awned.
 - f. Rachis-joints clavate, with a cupular hollow at the summit.
 - g. First glume of sessile spikelet glabrous.
 - h. Racemes spreading, rachis flexuose. 1. *A. condensatus*.
 - h. Racemes appressed, rachis straight.
 - i. Sessile spikelet 4(-5) mm. long. 4. *A. tener*.
 - i. Sessile spikelet 5-6 mm. long. 5. *A. cirratus*.
 - g. First glume of sessile spikelet not glabrous.
 - j. Sessile spikelet 9-10 mm. long; glume of sterile spikelet long-aristate. 3. *A. hirtiflorus*.
 - j. Sessile spikelet 5 mm. long; glume of sterile spikelet not aristate. 4. *A. tener hirtiglumis*.
 - f. Rachis-joints not clavate, not with a cupular hollow at the summit.
 - k. First glume of sessile spikelet pilose on keels. 7. *A. saccharoides*.
 - k. First glume of sessile spikelet glabrous.
 - l. Glume with a dorsal pit. 8. *A. altus*.
 - l. Glume not pitted.
 - m. Leaf-blades glabrous.
 - n. Blades less than 10 mm. wide at base, base not cordate. 12. *A. lateralis*.
 - n. Blades 15-20 mm. wide at base, base cordate. 13. *A. cordatus*.
 - m. Leaf-blades pubescent on both surfaces. 14. *A. leptocladus*.

1. **Andropogon condensatus** HBK. Nov. Gen. & Sp. 1: 188 (1816). Culms to 1 m. or more high. Leaves glabrous, the blades flat, linear, acute to subobtuse. Inflorescence much-branched, corymbose, the rachises flexuose, the rachis-joints clavate, cupular at the apex, unilaterally long-pilose. Sessile spikelets 4.5-5 mm. long, the glumes subequal, the first glume strongly bicarinate, the keels scabrid on upper portion; awn slender, flexuose, to 1 cm. long. Pedicellate spikelets reduced, the pedicels curved and unilaterally long-pilose. YUNGAS: *Bang* 276 (GH). LA PAZ: NOR YUNGAS: Milluguaya, 1300 m., *Buchtien* 38 (GH); Polo-Polo, near Coroico, 1100 m., *Buchtien* 205 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22639 (GH). SANTA CRUZ: SARA: Buenavista, 400-500 m., *Steinbach* 3302 (GH), 5165 (GH), 6809 (GH), 6951 (GH), 6952 (GH), 6953 (GH).

2. **A. virgatus** Desv. ex Hamilt. Prodr. Pl. Ind. Occ. 9 (1825). Culms to 2 m. high. Leaf-blades long, narrowly linear, glabrous above, pubescent beneath (glabrate in old leaves ?). Inflorescence elongate, much-branched, the rachis straight, spikelets densely appressed and ascending, rachis-joints shortly ciliate or ciliolate on the 2 margins, clavate with a cupular apex, racemes 1-2 cm. long, somewhat enclosed in the subtending red-brown or purplish spathes. Sessile spikelets

about 2.5-3 mm. long, the first glume strongly bicarinate, the keels scabrid-ciliolate, otherwise glabrous; lemma awnless. Pedicellate spikelets not reduced, about 2.5 mm. long, the glumes ciliolate on the keels, pedicels puberulent. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5344 (GH), 6945 (GH).

3. *A. hirtiflorus* (Nees) Kunth, *Rév. Gram.* 2: 569 (1832). *A. Riedelii* of the Catalogue. Culms to 1 m. tall, reddish. Leaves flat, linear, glabrous. Inflorescence much-branched, the rachis straight, racemes and spikelets ascending, rachis-joints pubescent, clavate, with a cupular apex, racemes 6-10 cm. long. Sessile spikelets to 9-10 mm. long, the first glume villous, aristate; lemma awned, the awn twisted, about 1-1.5 cm. long. Pedicellate spikes reduced, aristate, the pedicels pubescent. LA PAZ: LARECAJA: vic. Sorata; between Toquirani and San Pedro, 2700 m., *Mandon* 1385 (GH); between Choquecoa and Mt. Illampu, 3600 m., *Mandon* 1275 (GH); SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22658 (GH).

4. *A. tener* (Nees) Kunth, *Rév. Gram.* 2: 565 (1832). Densely tufted, the culms to 1 m. tall. Leaf-blades flat or involute, sometimes sparsely long-pilose above. Inflorescence very slender, the rachis straight, rachis-joints clavate, ciliate around the cupular apex and on 1 side, or nearly glabrous. Sessile spikelets 4-5 mm. long, the first glume glabrous or ciliolate on the keels; awn to 1 cm. long. Pedicellate spikelet reduced, shortly aristate. LA PAZ: LARECAJA: Sorata, *Mandon* 1383 (GH); Catarguata, 2700 m., *Mandon* 1381 (GH). TARIJA: ARCE: Camacho, 2500 m., *Fiebrig* 2859 (GH).

4a. *A. tener* subvar. *hirtiglumis* Henr. in *Meded. Rijks Herb. Leiden*, no. 40: 42 (1921). Resembling *A. tener* in most respects, but with the first glume of the sessile spikelet densely pilose. TARIJA: AVILES: Pinos, 2300 m., *Fiebrig* 3154 (GH; type-number).

5. *A. cirratus* Hack. in *Flora*, 68: 119 (1885). Culms to 7 dm. tall, tufted. Leaf-blades flat, linear, scabrid. Inflorescence narrow, the rachis straight, racemes appressed-ascending, rachis-joints unilaterally long-ciliate, clavate, with a cupular apex. Sessile spikelets to 5-6 mm. long, the first glume glabrous; awn to 1 cm. long. Pedicellate spikelets somewhat reduced, the first glume long-aristate, pedicels long-ciliate. TARIJA: CERCADO: Tucumilla, 2200 m., *Fiebrig* 2787 (GH).

6. *A. Hassleri* Hack. in *Bull. Herb. Boiss.* (ser. 2) 4: 266 (1904). Culms about 1 m. tall, the nodes glabrous. Linear leaf-blades scabridulous beneath. Inflorescence oblong, to 12 cm. long, pale, silky-villous, racemes appressed-ascending, rachis-joints long-silky-villous, especially on the margins. Sessile spikelets about 3 mm. long, pilose, especially on and near the rather rounded keels; awnless. Pedicellate spikelets greatly reduced, the aborted glume short-pubescent near the apex, pedicels densely long-villous. LA PAZ: SUR YUNGAS: Chulumani, 1600 m., *Hitchcock* 22659 (GH).

7. *A. saccharoides* Swartz, Prodr. 26 (1788). Culms tufted, to 1 m. tall, nodes hispid. Leaf-blades glabrous (occasionally some pubescence present), glaucous. Inflorescence to 15 cm. long, exserted, mostly silvery-white, silky-villous, the rachis-joints long-villous. Sessile spikelet about 5 mm. long, the first glume pilose on the keels; awn twisted below, 1(-1.5) cm. long. Pedicellate spikelets somewhat reduced, the pedicels long-villous. LA PAZ: MURILLO: Obrajes, 3400 m., *Buchtien* 574 (GH). COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22794 (GH); Quillacolla: Liriuni, 3000 m., *Steinbach* 9847 (GH).

7a. *A. saccharoides* subsp. *laguroides* (DC.) Hack. in DC. Monogr. Phan. 6: 495 (1889). *A. ternatus* var. *macrothrix* of the Catalogue. Culms shorter, nodes glabrous, and panicle smaller than in *A. saccharoides*. COCHABAMBA: CERCADO: Cochabamba, *Hitchcock* 22823 (Hitchcock).

7b. *A. saccharoides* subsp. *parvispiculus* Hitchc. in Contrib. U. S. Nat. Herb. 24: 497 (1927). *A. saccharoides* var. *barbinodis* of the Catalogue. Panicle longer, gray or purplish, sessile spikelets 3-4 mm. long. Leaf-blades often pubescent. LA PAZ: LARECAJA: Sorata, 2600-2700 m., *Mandon* 1389 (GH); MURILLO: La Paz, 3300 m., *Bang* 102 (GH); La Paz, 3500 m., *Buchtien* 8846 (GH); SUR YUNGAS: La Florida, 1840 m., *Hitchcock* 22615 (GH). COCHABAMBA: MIZQUE: Vila-vila, 2500 m., *Eyerdam* 24975 (GH).

7c. *A. saccharoides* subvar. *perforatus* (Trin.) Hack. in DC. Monogr. Phan. 6: 496 (1889). First glume of sessile spikelet with a supramedial dorsal pit. Otherwise like *A. saccharoides*. COCHABAMBA: CERCADO: Cochabamba, *Holway* 325 (Hitchcock).

8. *A. altus* Hitchc. in Contrib. U. S. Nat. Herb. 17: 208 (1913). Culms mostly solitary, the nodes bearded, to 1-2 m. high. Leaf-blades flat, linear, scabrid, with a few long hairs at base of upper surface. Panicle oblong, to 2 dm. long, greenish-white, rachis-joints densely long-villous. Sessile spikelet to 5 mm. long, the glabrous first glume with a supramedial dorsal pit; awn to 2 cm. long. Pedicellate spikelet greatly reduced, the pedicel long-villous. LA PAZ: NOR YUNGAS: Milluguaya, *Buchtien* 4258 (Hitchcock).

9. *A. bicornis* L. Sp. Pl. 1046 (1753). Culms to 1-2 m. tall, the nodes glabrous. Leaf-blades flat, linear, long-attenuate, scabrid. Inflorescence a corymbose, feathery, villous panicle, rachis-joints long-villous. Sessile spikelets about 3 mm. long, the first glume glabrous. Pedicellate spikelets greatly reduced, the pedicels long-villous. LA PAZ: LARECAJA: Hacienda Simaco, 1400 m., *Buchtien* 5312 (GH); NOR YUNGAS: Polo-Polo, near Coroico, 1100 m., *Buchtien* (in 1912) 204 (GH); Milluguaya, 1300 m., *Buchtien* (in 1917) 204 (GH). SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5274 (GH), 6949 (GH).

10. *A. leucostachyus* HBK. Nov. Gen. & Sp. 1: 187 (1816). Densely tufted, the culms usually less than 1 m. tall, the nodes glabrous.

Leaf-blades linear, flat, glabrous. Inflorescence a rather short villous panicle, the rachis-joints long-villous. Sessile spikelet awnless, about 3 mm. long, the first glume ciliolate on the keels and sometimes puberulent on the upper portion. Pedicellate spikelets greatly reduced, the pedicels long-villous. LA PAZ: NOR YUNGAS: Milluguaya, 1200 m., *Buchtien* 735 (GH). SANTA CRUZ: SARA: Dolores, 450 m., *Steinbach* 1888 (GH); Buenavista, 450 m., *Steinbach* 6517 (GH), 6845 (GH), 6846 (GH), 6848 (GH).

11. *A. Selloanus* (Hack.) Hack. in Bull. Herb. Boiss. (ser. 2) 4: 266 (1904). Culms mostly less than 1 m. tall, nodes glabrous. Inflorescence a densely villous panicle, the rachis joints densely long-villous on the upper portion. Sessile spikelets awnless, to 4 mm. long, the first glume glabrous. Pedicellate spikelets greatly reduced, the pedicels densely long-villous. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1928 (GH), 5143 (GH), 6515 (GH), 6516 (GH), 6723 (GH), 6874 (GH), 6971 bis (GH).

12. *A. lateralis* Nees, Agrost. Bras. 329 (1829). Culms to 1 m. tall, often purple, the nodes glabrous. Leaf-blades flat, linear, the base not cordate, to 6 mm. wide, glabrous. Inflorescence of 2-4 racemes to 4 cm. long, the rachis-joints long-villous. Sessile spikelet to 4-5 mm. long, the first glume glabrous; awn to 1 cm. long. Pedicellate spikelet not reduced, about 4 mm. long, the pedicel long-villous. SANTA CRUZ: SARA: Río Quimory, 400 m., *Steinbach* 7328 (GH); Buenavista, 450-500 m., *Steinbach* 5427 (GH), 6851 (GH).

13. *A. cordatus* Swallen in Contrib. U. S. Nat. Herb. 29: 275 (1948). Culms to nearly 2 m. tall. Leaf-blades glabrous, linear-attenuate, the base 15-20 mm. wide and cordate. Inflorescence to 5 dm. long, racemes to 4.5 cm. long, the rachis-joints villous. Sessile spikelet to 4 mm. long, the first glume glabrous; awn to 1.5 cm. long. Pedicellate spikelets to 6.5 mm. long, the pedicel long-villous. COCHABAMBA: TOTORA: Chimoré, 1000 m., *Cárdenas* 2083 (US; type).

14. *A. leptocladus* Hack. in Flora, 68: 122 (1885). Culms to 4 dm. high, the nodes short-hispid. Leaf-blades bristly-pilose at base, pubescent on both surfaces (at least when young), linear, long-attenuate. Inflorescence exserted, of few racemes, the rachis-joints long-hispid. Sessile spikelet about 6 mm. long, the first glume glabrous or with a few short hairs near the base; awn strongly geniculate, to 4 cm. long. Pedicellate spikelet to 5-6 mm. long, the short pedicel bilaterally ciliate. SANTA CRUZ: SARA: Río Guendá, 400 m., *Steinbach* 7939 (GH).

100. *Hyparrhenia* Anderss.

Hyparrhenia bracteata (Humb. & Bonpl. ex Willd.) Stapf in Prain, Fl. Trop. Afr. 9: 360 (1918). Perennial, to 1 m. high, or more. Leaf-blades long, linear, narrow (to 4 mm.), appressed-pilose beneath. Inflorescence terminal, to 3 dm. or more, a complex panicle of paired

racemes, these subtended by narrow pilose bracts, 1-2.5 cm. long, the ultimate racemes few-flowered. Spikelets 1-flowered, paired, 1 sessile, fertile, and awned, the other (sometimes 2) pedicellate, the pedicel long-villous, sterile and awnless; disarticulation below the glumes. Fertile spikelet: about 6 mm. long (excluding the awn), the glumes somewhat indurate; first glume with involute margins, bidentate, a few longish hairs near the apex, second glume similar but not bidentate; fertile lemma thin, delicate, shorter than the glumes, the subplumose awn to 2.5 cm. long, loosely twisted. Sterile spikelet: shorter than the fertile, not bidentate, the apices pubescent and subaristate. LA PAZ: SUR YUNGAS: Chulumani, *Hitchcock* 22704 (*Hitchcock*).

101. *Sorghum* Moench

Sorghum vulgare Pers. Synops. Pl. 1: 101 (1805). Robust annual, the culms to 1.5 m. high. Leaf-blades long, 2-6 cm. wide, glabrous. Inflorescence a terminal panicle, often condensed, of several few-jointed racemes, these tardily disarticulating. Spikelets paired, the perfect spikelet sessile, the staminate or sterile spikelet pedicellate. Perfect spikelet: glumes subequal, about 5 mm. long, broadly ovate, the first glume few-nerved, more or less shortly silky-villous, the second glume indurate, shining; lemma shorter than the glumes, awned, the awn geniculate, basally twisted, to 1 cm. long, quickly deciduous. Sterile spikelet: pedicel villous, glumes 3-4 mm. long, few-nerved, very sparsely villous. LA PAZ: NOR YUNGAS: Coroico, *Buchtien* 3615 (*Hitchcock*).

The perennial *S. halepense* (L.) Pers. Synops. Pl. 1: 101 (1805) may also be found. It has an extensive, creeping, scaly rhizome and, in general, is somewhat more robust than is *S. vulgare*.

102. *Sorghastrum* Nash

Perennials, to 1 m. high, the culm-nodes pubescent to shortly villous, the leaf-sheaths rather prominently auriculate, the blades glabrous to scabrid. Inflorescence a panicle of short racemes, the rachis disarticulating. Spikelets paired, the perfect spikelet sessile or subsessile, the sterile spikelet reduced to a pubescent or villous pedicel. Glumes coriaceous, the fertile lemma hyaline, awned.

- a. Awn to 8 cm. long. 1. *S. minarum*.
 - a. Awn much less than 8 cm. long.
 - b. Awn less than 1 cm. long, straight or once geniculate, not tightly twisted at base. 2. *S. parviflorum*.
 - b. Awn to nearly 2 cm. long, twice geniculate, tightly twisted at base. 3. *S. stipoides*.
1. *Sorghastrum minarum* (Nees) Hitchc. in Contrib. U. S. Nat.

Herb. 24: 501 (1927). Leaf-blades long, mostly flat. Panicles rather dense, somewhat spicate in appearance. Perfect spikelet: glumes equal or subequal, obtuse, to 1 cm. long, the first glume glabrous to sparsely villous on the upper portion, the apex shortly ciliate; second glume glabrous, the apex shortly ciliate. Awn once or twice geniculate, the basal portion tightly twisted, plumosely ciliate, dark brown, the upper portion light brown, straight, shortly scabrid-pubescent. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 5430 bis (GH), 7028 (GH).

2. *S. parviflorum* (Desv.) Hitchc. & Chase in Contrib. U. S. Nat. Herb. 18: 287 (1917). Tufted, the leaf-blades flat to involute. Panicle more open, the pedicels and spikelet-bases villous. Perfect spikelet: glumes subequal, 4-5 mm. long, subacute, glabrous or the first glume sparsely villous. Awn glabrous to faintly scabridulous. SANTA CRUZ: SARA: Buenavista, 450-500 m., *Steinbach* 1819 (GH), 5428 (GH), 6984 (GH), 7050 bis (GH).

3. *S. stipoides* (HBK.) Nash, N. Amer. Fl. 17: 129 (1912). Slender, leaf-blades narrow, convolute. Perfect spikelet: glumes equal, 5-6 mm. long, subobtuse, the first glume sparsely villous. Awn light brown, the tightly twisted basal portion somewhat plumose-ciliate. LA PAZ: LARECAJA: vic. Sorata, *Mandon* 1382 (Hitchcock). SANTA CRUZ: VALLEGRANDE: Valleggrande, *Herzog* 1789 (Hitchcock).

103. *Heteropogon* Pers.

Perennial or annual. Racemes solitary, digitate, or subdigitate. Staminate spikelets pedicellate, awnless, paired (2-5 pairs) on lowest portion of rachis, this remaining entire. Fertile spikelets sessile, 2-flowered, awned, the lower floret a sterile lemma, each paired with a pedicellate staminate spikelet above the paired staminate spikelets, the rachis disarticulating obliquely, leaving a sharp villous callus below each fertile spikelet.

a. Racemes 2-7, digitately arranged (occasionally solitary on axillary branches); awns to 5 cm. long; pedicels villous. 1. *H. villosus*.

a. Racemes solitary; awns 12-15 cm. long; pedicels glabrous.

b. Glumes all glandless. 2. *H. contortus*.

b. First glume of staminate spikelets with a dorsal row of punctate glands. 3. *H. melanocarpus*.

1. *Heteropogon villosus* Nees, Agrost. Bras. 362 (1829). *Andropogon villosus* and *Agenium villosum* of the Catalogue. Perennial, erect or spreading, the culms to 1 m. tall, nodes pubescent to villous. Leaf-sheaths pubescent to glabrate, ciliate, the linear acute blades to 10 cm. long and 4 mm. wide, pubescent above and beneath. Inflorescence a terminal panicle of 2-7 digitately or subdigitately arranged racemes on villous peduncles to 1 cm. long, the racemes to 3 cm. long (excluding awns). Staminate spikelets: pedicels villous; first glume to 6 mm. long, acute, hispid to papillate-hispid on upper portion,

many-nerved; second glume somewhat shorter, glabrous, thin-textured, several-nerved; lemma shorter, hyaline, ciliate, the hairs soft and curling. Fertile spikelets: 5 mm. long, excluding awns; first glume 4.5 mm. long, obtuse, villous, only slightly papillate; second glume slightly shorter, acute, sparsely pubescent; lemma about 3 mm. long, thin, terminated by an awn 2.5-5 cm. long, basally twisted, geniculate, ultimately straight, pubescent to apically puberulent. SANTA CRUZ: CERCADO: Santa Cruz, *Herzog* 1308 (*Hitchcock*).

2. *H. contortus* (L.) Beauv. ex Roem. & Schult. Syst. Veg. 2: 836 (1817). Perennial, to 8 dm. or 1 m. tall, the culms compressed, nodes glabrous. Leaf-sheaths glabrous, carinate, the linear, acute blades to 15 cm. long and 7 mm. wide, scabridulous above but scarcely so beneath. Inflorescence a terminal, 1-sided raceme about 5 cm. long (excluding awns). Staminate spikelets imbricate, to 1 cm. long, pedicels glabrous; first glume to 1 cm. long, acute, finely short-ciliate, sparsely papillate-hispid above, many-nerved; second glume nearly as long, thin, 1-nerved, glabrous; lemma shorter, hyaline. Fertile spikelets to 7 mm. long; glumes equal, the first brown, densely pubescent, enclosing the second; lemma short, bearing a geniculate, basally twisted awn to 12 (-15) cm. long, the base pubescent to plumose, the apex finely puberulent. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22678 (GH). CHUQUISACA: SUR CINTI: Camataquí, 2500 m., *Fiebrig* 3074 (GH).

3. *H. melanocarpus* (Ell.) Benth. in Journ. Linn. Soc. Bot. 19: 71 (1882). Annual, to 2 m. tall. Leaf-sheaths glabrous, carinate, the keel with a row of small glands, especially on sheaths of upper leaves, the lance-linear blades to 30 cm. long and 1 cm. wide, scabrid above and beneath. Inflorescences often densely crowded in upper leaves, the racemes to 6 cm. long (excluding the awns); inflorescence to 2-3 dm. long. Staminate spikelets to 1.5-2.5 cm. long, glabrous, the pedicels glabrous; first glume acute, many-nerved, the margins hyaline, with a dorsal line of flat punctate glands in the middle of the glume. Fertile spikelets about 7-10 mm. long; glumes equal, firm, subacute to obtuse, dark brown, pubescent; lemma shorter, thin, bearing a 10-12 cm. geniculate awn, the base twisted, pubescent to subplumose, the upper half straight, puberulent. LA PAZ: NOR YUNGAS: Coripata, *Hitchcock* 22678 (GH).

104. *Trachypogon* Nees

Perennials. Racemes terminal, 1-3 in an inflorescence, the rachis disarticulating. Spikelets paired, the staminate spikelet awnless, sessile or nearly so, persistent; perfect spikelet awned, pedicellate, the pedicel disarticulating, leaving a sharp villous callus below the spikelet.

a. Leaf-blades glabrous to scabrid.

b. Racemes usually solitary; awn pubescent; glume of staminate spikelet pubescent. 1. *T. montufari*.

- b. Racemes 2-3; awn plumose; glume of staminate spikelet glabrous. 2. *T. plumosus*.
 a. Leaf-blades villous. 3. *T. canescens*.

1. **Trachypogon montufari** (HBK.) Nees, Agrost. Bras. 342 (1829). *T. polymorphus* var. *bolivianus* Pilger in Engler, Bot. Jahrb. 27: 22 (1899). Culms to 1 m. tall, the nodes hispid to villous. Leaf-sheaths glabrous, auricles erect, to 1 cm. long, the flat or involute blades to 8 mm. wide, shorter than the inflorescence, glabrous but scabridulous. Inflorescence usually a solitary raceme to 15 cm. long. Staminate spikelet: first glume to 7 mm. long, subacute, dorsally rounded, many-nerved, sparsely pubescent and shortly hispid-ciliate; second glume to 8 mm. long, acute, few-nerved, glabrous or softly and sparsely pubescent along the margins; lemma shorter, hyaline, long-ciliate, the hairs soft. Perfect spikelet: glumes nearly equal, to 7-8 mm. long, few-nerved, firm-textured, pubescent; lemma shorter, hyaline, the geniculate awn to 6 cm. long, densely long-pubescent, the hairs shorter toward the apex. Bolivian Plateau: *Bang* 1079 (GH; type-number of *T. polymorphus* var. *bolivianus*). SANTA CRUZ: SARA: Buenavista, 500 m., *Steinbach* 5379 (GH). TARIJA: ARCE: Camacho, *Fiebrig* 2864 (GH).

2. **T. plumosus** (Humb. & Bonpl. ex Willd.) Nees, Agrost. Bras. 344 (1829). Taller than *T. montufari*; racemes 2-3 (rarely 1); awn plumose; first glume of staminate spikelet glabrous. LA PAZ: LARECAJA: Hacienda Casana, *Buchtien* 7145 (Hitchcock).

3. **T. canescens** Nees, Agrost. Bras. 343 (1829). Very similar to *T. montufari*, but the leaf-sheaths sparsely hispid to papillate-hispid, the involute blades villous. Awn plumose, at least below. LA PAZ: NOR YUNGAS: Puente Villa, 1700 m., *Cárdenas* 3613 (GH). SANTA CRUZ: SARA: Buenavista, 450 m., *Steinbach* 6947 (GH).

105. **Elyonurus** Humb. & Bonpl. ex Willd.

Perennial, up to 1 m. tall, the terminal racemes usually solitary, to 10-15 cm. long, often much shorter, the rachis ultimately disarticulating. Spikelets paired, awnless; staminate spikelet pedicellate; perfect spikelet sessile, appressed against the rachis; spikelet-pairs falling attached to a rachis-joint. Glumes entire or bidentate, slightly glandular on the marginal nerves; lemmas hyaline, thin-textured; palea obsolete.

- First glume of staminate spikelet entire. 1. *E. adustus*.
 First glume of staminate spikelet bidentate (sometimes only slightly so.) 2. *E. tripsacoides*.

1. **Elyonurus adustus** (Trin.) Ekman in Ark. Bot. 13(10): 6 (1913). Caespitose, the bases slightly bulbous. Leaf-sheaths glabrous, the linear, flat or inrolled, scabridulous leaf-blades to 4 mm. wide, shorter than the inflorescence. Raceme-rachis and pedicels pubescent to villous. Staminate spikelets: glumes subequal, about 5 mm. long, entire, acute,